

**(Established under the Presidency University Act, 2013 of the Karnataka Act 41 of 2013)**

**[2022-23 EVEN/ WINTER SEMESTER]**

**COURSE HAND OUT [Revision 02 - Jan 2022]**

**SCHOOL: CSE&IS DEPT: CSE DATE OF ISSUE: 27.01.2023**

**NAME OF THE PROGRAM : B.Tech[COM]**

**P.R.C. APPROVAL REF. : BOS Document number which is being referred for this CHO**

**SEMESTER/YEAR : 04/02 [2022-2023]**

**COURSE TITLE & CODE : Data Analysis and visualization & CSE2015**

**COURSE CREDIT STRUCTURE : 2-4-4**

**CONTACT HOURS : 6 Periods per Week**

**COURSE IC : Dr. Ragaventhiran, Mr. Sachin Jain**

**COURSE INSTRUCTOR(S) : Ms.Poornima G, Dr.Vignesh R, Ms. Yogeetha B.R,**

**Ms. Ashishika Singh, Ms. Leelambika K.V, Mr. Riyaz,**

**COURSE URL : CAMU LINK**

**PROGRAM OUTCOMES :**

**PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.**

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO-4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.**

**PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.**

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO-9: Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.**

**PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.**

**PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.**

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**COURSE PREREQUISITES:** Basic knowledge of Math’s. Basic understanding of contour maps. Theoretical awareness of conventional instruments and Total station.

**COURSE DESCRIPTION:** The purpose of the course is to instill a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts. The associated laboratory provides an opportunity to strengthen student’s skillset in the arena of Data Preprocessing and Visualization. With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers.

**COURSE OUTCOMES: On successful completion of the course the students shall be able to:**

|  |  |  |
| --- | --- | --- |
| **TABLE 1: COURSE OUTCOMES** | | |
| **CO Number** | **Course Outcomes** | **Expected BLOOMS LEVEL** |
| **CO1** | Interpret various types of data and the principles of data visualization. | **Comprehension** |
| **CO2** | Apply visualization techniques to a problem and its associated dataset. | **Application** |
| **CO3** | Create interactive visualization for better insight using various visualization tools. | **Application** |
| **CO4** | Manipulate streaming data using various techniques | **Application** |

**MAPPING OF C.O. WITH P.O. [H-HIGH , M- MODERATE, L-LOW]**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO.**  **No** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 |
| **CO1** | H |  |  | M | M |  |  |  | M | M | L |  |
| **CO2** | H |  |  | M | H |  |  |  | M | M | L |  |
| **CO3** | M |  |  | M | H |  |  |  | H | H | L |  |
| **CO4** | H |  |  | M | H |  |  |  | H | M | L |  |

**COURSE CONTENT (SYLLABUS):**

**Module 1: Introduction to Data Visualization** [12 Sessions] [Bloom’s Level Selected: Comprehension]

Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation.

**Python Libraries**: NumPy, pandas, matplotlib, GGplot, Introduction to pandas Data Structures

**Module 2: Data Visualization Techniques** [12 Sessions] [Bloom’s Level Selected: Application]

Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data, Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.

**Module 3: Visual Analysis of data from various domain** [12 Sessions] [Bloom’s Level Selected: Application]

Time-oriented data visualization – Spatial data visualization, Text data visualization – Multivariate data visualization and case studies, Finance- marketing-insurance-healthcare etc.

**Module 4: Visualization of Streaming Data** [10 Sessions] [Bloom’s Level Selected: Application]

Guidelines for designing successful visualizations, Data visualization dos and don’ts, Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.

**SKILL SETS TO BE DEVELOPED:**

Graduate of the B.Tech. Program in Computer Scienc and Engineering shall be able to;

1. **An attitude of enquiry.**
2. **Confidence and ability to tackle new problems.**
3. **Ability to interpret events and results.**
4. **Ability to work as a leader and as a member of a team.**
5. **Assess errors in systems/processes/programs/computations and eliminate them.**
6. Observe and measure physical phenomena.
7. Write reports.
8. **Select suitable equipment, instrument, materials & software**
9. **Locate faults in system/Processes/software.**
10. **Manipulative skills for setting and handling systems/Process/ Issues**
11. The ability to follow standard /Legal procedures.
12. An awareness of the Professional Ethics.
13. Need to observe safety/General precautions.
14. To judge magnitudes/Results/issues without actual measurement/actual contacts

**DELIVERY PROCEDURE (PEDAGOGY):**

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| **TABLE 3: SPECIAL DELIVERY METHOD/ PEDAGOGY PLANNED WITH TOPICS** | | | | |
| **S. No** | **Lecture Number** | **Subtopic as per lesson Plan** | **Pedagogy title/ short explanation of adopted pedagogy** | **\*\* At end of semester please update whether activity was done** |
| 1 | L10 | Four Levels for Validation Scalar and Point techniques | Self-Learning |  |
| 2 | L17 | Data Analysis: The problems you face when handling large data, General techniques for handling large volumes of data, | Flipped Classroom |  |
| 3 | L23 | Case studies, Finance- marketing-insurance-healthcare etc. | Blended Learning using Videos |  |
| 4 | L26 | Height Plots - Vector visualization techniques | Experiential Learning using Google Colab |  |

**REFERENCE MATERIALS:**

**Text Book:**

1. McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O’Reilly Media.
2. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.
3. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O’Reilly Media, Inc., 2018
4. Dr. OssamaEmbarak,“Data Analysis andVisualization Using Python”, Apress,(2018)

**Reference Book:**

**R1.** Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.

**R2.**  Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

**R3.** García Salvador, LuengoJulián, & Herrera, F. “Data preprocessing in Data Mining”, Springer,(2015)

**R4.** Stephen Few, “Information Dashboard Design: the effective visual communication of data”, Oreilly, 2006

**R5.** Belorkar, A, “Interactive Data Visualization with Python” - [S.l.]: Packt Publishing, Second Edition. (2018)

**Web links:**

**R1.** https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/

**R2.**  [Google Data Analytics Professional Certificate | Coursera](https://www.coursera.org/professional-certificates/google-data-analytics?utm_source=bg&utm_medium=sem&utm_campaign=B2C_INDIA_google-data-analytics_google_FTCOF_professional-certificates_arte_bing&utm_content=B2C_INDIA_google-data-analytics_google_FTCOF_professional-certificates_arte-agency_bing&campaignid=415452288&adgroupid=1217159849562313&device=c&keyword=analytics%20course%20online&matchtype=p&network=o&devicemodel=&adpostion=&creativeid=&hide_mobile_promo&msclkid=9decb84b6c281b45049ddbe939dc8a2c&utm_term=analytics%20course%20online)

**R3.**  [Learning Python for Data Analysis and Visualization Ver 1 | Udemy](https://www.udemy.com/course/learning-python-for-data-analysis-and-visualization/?matchtype=p&msclkid=137cc5684f66130ba3e1a6ca1a921127&utm_campaign=BG-LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=bing&utm_term=_._ag_1213861250188822_._ad__._kw_%2BData+%2BVisualization+%2BCourse_._de_c_._dm__._pl__._ti_kwd-75866640232682%3Aloc-90_._li_157572_._pd__._)

**SPECIFIC GUIDELINES TO STUDENTS:**

1. Students are required to maintainminimum 75% of attendance
2. Technology enabled learning through NPTEL and online course may help in clear understanding the topics.
3. Follow the instructions of course instructor in both class and lab.
4. Avoid being absent in labs as it will affect the understanding of the experiments.
5. On time submission of assignments.

**COURSE SCHEDULE:**

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| **TABLE 4: COURSE BROAD SCHEDULE** | | | | | |
| **Sl. No.** | **ACTIVITY** | **PLANNED STARTING DATE** | | **PLANNED CONCLUDING DATE** | **TOTAL NUMBER OF PERIODS** |
| 01 | Over View of the course | 16.02.2023 | | 16.02.2023 | 01 |
| 02 | Module : 01 | 17.02.2023 | | 08.03.2023 | 12 |
| 03 | Module: 02 | 09.03.2023 | | 25.03.2023 | 12 |
| 04 | MIDTERM | As per COE schedule | | | |
| 05 | Module:03 | 27.03.2023 | 11.04.2023 | | 12 |
| 06 | Module:04 | 17.04.2023 | 08.05.2023 | | 12 |
| 07 | Revision and Conclusion of the Course | 10.05.2023 | 12.05.2023 | | 02 |
| 08 | End term Examination | As per COE schedule | | | |

**DETAILED SCHEDULE OF INSTRUCTION:**

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| **TABLE 5: DETAILED COURSE SCHEDULE/ LESSON PLAN** | | | | |
| **Session no** | **TOPIC** | **SUBTOPIC** | **CO Number** | **Reference** |
|  | **Introduction to Data Visualization** | Overview of the Course | **CO1** | **--** |
|  | **Introduction to Data Visualization** | Data collection | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Data Preparation | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Overview of data visualization | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Interacting with Databases | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Data Cleaning and Preparation | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Handling Missing Data | **CO1** | **T1 & T2** |
|  | **Introduction to Data Visualization** | Data Transformation | **CO1** | **T1 & T2** |
|  | **Data Visualization Techniques** | Scalar and Point Techniques | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Vector Visualization Techniques | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Matrix Visualization | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Visualization Techniques for Trees,Graphs, and Networks | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Visualization Techniques for Graphs, and Networks | **CO2** | **T2** |
|  |  | Multidimensional data | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Visual Variables- Networks and Trees | **CO2** | **T2** |
|  | **Data Visualization Techniques** | Map Color and Other Channels- Manipulate View- Heat Map. | **CO2** | **T1 & T2** |
|  | **Visual Analysis of data from various domain** | Data Analysis | **CO3** | **T1 & T2** |
|  | **Visual Analysis of data from various domain** | Time-oriented data visualization | **CO3** | **T1 & T2** |
|  | **Visual Analysis of data from various domain** | Spatial data visualization | **CO3** | **T1 & T2** |
|  | **Visual Analysis of data from various domain** | Text data visualization | **CO3** | **T1 & T2** |
|  | **Visual Analysis of data from various domain** | Multivariate data visualization | **CO3** | **T3** |
|  | **Visual Analysis of data from various domain** | case studies, Finance- marketing-insurance-healthcare etc. | **CO3** | **T3** |
|  | **Visual Analysis of data from various domain** | Case studies, Finance- marketing-insurance-healthcare etc. | **CO3** | **T3** |
|  | **Visualization of Streaming Data** | Guidelines for designing successful visualizations | **CO4** | **T3** |
|  | **Visualization of Streaming Data** | Data visualization dos and don’ts, best practices of Data Streaming | **CO4** | **T3** |
|  | **Visualization of Streaming Data** | Processing streaming data for visualization | **CO4** | **T4** |
|  | **Visualization of Streaming Data** | Presenting streaming data | **CO4** | **T4** |
|  | **Visualization of Streaming Data** | Streaming visualization techniques. | **CO4** | **T4** |
|  | **Visualization of Streaming Data** | Streaming analysis. | **CO4** | **T4** |

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| **TABLE 5.1: DETAILED COURSE SCHEDULE/ LESSON PLAN (Lab Programs)** | | | | |
| **Session no** | **TOPIC** | **SUBTOPIC** | **CO Number** | **Reference** |
| **1** | Laboratory Familiarization | Introduction to Colab and Writing Simple programs in python | **CO1** | T1 |
| **2** | Working with Numpy and Pandas | Introduction to Numpy and Pandas. Write a python program using Numpy and Pandas | **CO1** | T1 |
| **3** | Acquiring data and plotting the graph | Using the given dataset write a program to plot the data in various graphs using python. | **CO1** | T1 |
| **4** | Practicals based on Data Cleaning and Preparation | Practicals based on Data Cleaning and Preparation | **CO2** | T1 |
| **5** | Practicals based on Data Wrangling | Practicals based on Data Wrangling | **CO2** | T1 |
| **6** | Statistical Analysis – such as Multivariate Analysis, PCA, LDA, | Statistical Analysis – such as Multivariate Analysis, PCA, LDA, | **CO2** | T1 |
| **7** | Correlation regression and analysis of variance | Correlation regression and analysis of variance | **CO2** | T1 |
| **8** | Practicals based on Data Visualization using matplotlib | Practicals based on Data Visualization using matplotlib | **CO3** | T1 |
| **9** | Visualization of various massive dataset - Finance - Healthcare - Census | Visualization of various massive dataset - Finance - Healthcare - Census | **CO3** | T1 |
| **10** | Practical based on Time Series Data Analysis-stock market  Market-Basket Data analysis | Practical based on Time Series Data Analysis-stock market  Market-Basket Data analysis | **CO2** | T1 |
| **11** | Text visualization using web analytics | Text visualization using web analytics | **CO3** | T1 |
| **12** | Financial analysis using Clustering, Histogram and HeatMap | Financial analysis using Clustering, Histogram and HeatMap | **CO4** | T1 |
| **13** | Visualization on Streaming dataset (Stock market dataset, weather forecasting) | Visualization on Streaming dataset (Stock market dataset, weather forecasting) | **CO4** | T1 |

**COURSE CONTENT &TASK SCHEDULE FOR LABORATORY COMPONENT:**

| **Sl. No.** | **Session No** | **Task No** | **Task** | **Level 1** | **Level 2** | **Number of Lab Sessions required to complete the task** | **Skills to be developed** | **Course Outcome to be developed** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **01** | **P1** | **1** | Laboratory Familiarization | Introduction to Colab | Execution of Python programs in Colab | 1 | SK1, SK2, SK3 | 1 |
| **02** | **P2** | **2** | **Lab Sheet 1**:  Working with Numpy and Pandas | Introduction to tools to be used. | Introduction to NumPy, Pandas | 2 | SK1, SK3, SK5, SK8 | 1 |
| **03** | **P3** | **3** | Acquiring data and plotting the graph | Works on plotting techniques | Ggplot, matplotlib | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 1 |
| **04** | **P4** | **4** | **Lab Sheet2:**  Practicals based on Data Cleaning and Preparation | Data cleaning | Identify various methods for cleaning the data in python | **1** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 2 |
| **05** | **P5** | **5** | Practicals based on Data Wrangling | Data Wrangling | Use wrangling methods to simplify and combine the complex data. | **1** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 2 |
| **06** | **P6** | **6** | Statistical Analysis – such as Multivariate Analysis, PCA, LDA, | Statistical Analysis | PCA, LDA, Regression using Python | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 2 |
| **07** | **P7** | **7** | Correlation regression and analysis of variance | Correlation and Regression | PCA, LDA, Regression using Python | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 2 |
| **08** | **P8** | **8** | **Lab Sheet3:**  Practicals based on Data Visualization using matplotlib | Introduction to matplotlib | Visualization using matplotlib | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 3 |
| **09** | **P9** | **9** | Visualization of various massive dataset - Finance - Healthcare - Census | Visualization techniques | Apply various visualization techniques for the given dataset | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 3 |
| **10** | **P10** | **10** | **Lab Sheet 4:**  Practical based on Time Series Data Analysis-stock market  Market-Basket Data analysis | Introductio to Time series data | Use statistical methods for handling time series data | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 3 |
| **11** | **P11** | **11** | visualization  Text visualization using web analytics | Text Visualization | Use web analytics in python for analyzing the text documents | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 3 |
| **12** | **P12** | **12** | **Lab Sheet 5:**  Financial analysis using Clustering, Histogram and HeatMap | Introduction to Histogram and heatmap | Generating heatmap for the given dataset | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 4 |
| **13** | **P13** | **13** | Visualization on Streaming dataset (Stock market dataset, weather forecasting) | Visualization on Streaming dataset | Visualizing the live data from the internet | **2** | SK1, SK2, SK3, SK5, SK6, SK7, SK8, SK9 | 4 |

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| **Sl. No.** | **Activity** | **Starting Date** | **Concluding Date** | **Total Number of Periods** |
| **01** | Laboratory Familiarization | 16.02.2023 | 17.02.2023 | 2 |
| **02** | Conduct of first set of experiments | 17.02.2023 | 28.03.2023 | 11 |
| **03** | Lab Test | As per COE schedule | | -- |
| **04** | Conduct of second set of experiments | 29.03.2023 | 08.05.2023 | 12 |
| **05** | End Term Evaluation | As per COE schedule | | -- |

**Lab Component:**

**ASSESSMENT SCHEDULE: Theory Component**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 6 ASSESSMENT SCHEDULE** | | | | | | | |
| **Sl.no** | **Assessment type** | **Contents** | **Course outcome**  **Number** | **Duration**  **In Hours** | **marks** | **Weightage** | **Venue, DATE &TIME** |
| **1** | **Assignment** | **Module-1&2** | **CO1,CO2** | **2** | **20** | **10%** |  |
| **2** | **End Term Exam** | **Full Syllabus** | **CO1, CO2, CO3, CO4** | **1** | **40** | **20%** |  |

**ASSESSMENT SCHEDULE: Laboratory Component**

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **TABLE 6 ASSESSMENT SCHEDULE** | | | | | | | |
| **Sl.no** | **Assessment type** | **Contents** | **Course outcome**  **Number** | **Duration**  **In Hours** | **marks** | **Weightage** | **Venue, DATE &TIME** |
| **1** | **Quiz/Assignment** | **All Modules** | **CO1, CO2, CO3, CO4** | **30 Minutes** | **20** | **10%** |  |
| **2** | **Mid Term Exam** | **Module 1**  **Module 2** | **CO1, CO2** | **2** | **40** | **20%** |  |
| **3** | **Online Certification Course** | **Simply Learn** | **CO1, CO2, CO3, CO4** | **6** | **20** | **10%** |  |
| **4** | **End term Exam** | **Full Syllabus** | **CO1, CO2, CO3, CO4** | **2** | **60** | **30%** |  |

**COURSE CLEARANCE CRITERIA:**

“AS PER ACADEMIC REGULATIONS OF THE UNIVERSITY”

**MAKEUP EXAM POLICY:**

“AS PER ACADEMIC REGULATIONS OF THE UNIVERSITY”

**CONTACT TIMINGS IN THE CHAMBER FOR ANY DISCUSSIONS:**

As Per the faculty Time Table

**SAMPLE THOUGHT PROVOKING QUESTIONS:** (Here type sample typical questions for students ’reference, **only a few but those few should be thought provoking type)**

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| **TABLE 7: SAMPLE THOUGHT PROVOKING QUESTIONS** | | | | |
| **SL NO** | **QUESTION** | **MARKS** | **COURSE OUTCOME NO.** | **BLOOM’S LEVEL** |
| 1 | The sinking of the Titanic is one of the most infamous shipwrecks in history. On April 15, 1912, during her maiden voyage, the widely considered “unsinkable” RMS Titanic sank after colliding with an iceberg. Unfortunately, there weren’t enough lifeboats for everyone onboard, resulting in the death of 1502 out of 2224 passengers and crew. While there was some element of luck involved in surviving, it seems some groups of people were more likely to survive than others. In this problem, we ask you to build a predictive model and visualization that answers the question: “what sorts of people were more likely to survive?” using passenger data (ie name, age, gender, socio-economic class, etc). | 10 | CO2 | Application |
| 2 | The Roche Data Science Coalition (RDSC) is requesting the collaborative effort of the AI community to fight COVID-19. This challenge presents a curated collection of datasets from 20 global sources and asks you to model solutions to key questions that were developed and evaluated by a global frontline of healthcare providers, hospitals, suppliers, and policy makers.  **Dataset Description:** This dataset is composed of a curated collection of over 200 publicly available COVID-19 related datasets from sources like Johns Hopkins, the WHO, the World Bank, the New York Times, and many others. It includes data on a wide variety of potentially powerful statistics and indicators, like local and national infection rates, global social distancing policies, geospatial data on movement of people, and more. Develop an interactive war room dashboard to assist WHO and countries to take appropriate action to contain COVID-19 | 20 | CO2,CO3 | Application |
| 3 | University is requesting the help of data analyst for improving the performance of the students in various aspects. The dataset contains the previous observation of the students including the parent degree. The data analysis team are pretend to identify the performance of the students based on different criteria and visualize the results using plots in python.  **Dataset Description:**  The dataset “Students Performance in Exams” can be downloaded from Kaggle. It contains 8 fields and curetted digital data of over 500 students. | 20 | CO3, CO4 | Application |

**TARGET SET FOR COURSE OUTCOME ATTAINMENT:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **TABLE 8: TARGET SET FOR ATTAINMENT OF EACH CO and ATTAINMENT ANALYSIS AFTER RESULTS** | | | | | | |
| **Sl.no** | **C.O. No.** | **Course Outcomes** | **Threshold Set for the CO** | **Target set for attainment in percentage** | **Actual C.O. Attainment**  **In Percentage \*** | **Remarks on attainment &Measures to enhance the attainment \*** |
| 01 | CO1 | Interpret various types of data and the principles of data visualization. | 60% | 65% |  |  |
| 02 | CO2 | Apply visualization techniques to a problem and its associated dataset. | 50% | 60% |  |  |
| 03 | CO3 | Create interactive visualization for better insight using various visualization tools. | 50% | 60% |  |  |
| 04 | CO4 | Manipulate streaming data using various techniques | 50% | 60% |  |  |



Signature of the course Instructor In-Charge (s)

APPROVAL:

This course has been duly verified Approved by the D.A.C.

Signature of the Chairperson D.A.C.

Name and signature of the Instructor In-Charge (s)

Name and signature of the DAC Chairperson

**BLOOM'S TAXONOMY SAMPLE VERBS**

Learning Outcomes Verbs at Each Bloom Taxonomy Level to be used for writing the course Outcomes.

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| --- | --- | --- |
| **TABLE 9: REFERENCE SAMPLES OF BLOOMS TAXONOMY VERBS** | | |
| Cognitive Level | Illustrative Verbs | Definitions |
| Knowledge | arrange, define, describe, duplicate, identify, label, list, match, memorize, name, order, outline, recognize, relate, recall, repeat, reproduce, select, state | remembering previously learned information |
| Comprehension | classify, convert, defend, discuss, distinguish, estimate, explain, express, extend, generalize, give example(s), identify, indicate, infer, locate, paraphrase, predict, recognize, rewrite, report, restate, review, select, summarize, translate | grasping the meaning of information |
| Application | apply, change, choose, compute, demonstrate, discover, dramatize, employ, illustrate, interpret, manipulate, modify, operate, practice, predict, prepare, produce, relate schedule, show, sketch, solve, use write | applying knowledge to actual situations |
| Analysis | analyze, appraise, breakdown, calculate, categorize, classify, compare, contrast, criticize, derive, diagram, differentiate, discriminate, distinguish, examine, experiment, identify, illustrate, infer, interpret, model, outline, point out, question, relate, select, separate, subdivide, test | breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized |
| Synthesis | arrange, assemble, categorize, collect, combine, comply, compose, construct, create, design, develop, devise, explain, formulate, generate, plan, prepare, propose, rearrange, reconstruct, relate, reorganize, revise, rewrite, set up, summarize, synthesize, tell, write | rearranging component ideas into a new whole |
| Evaluation | appraise, argue, assess, attach, choose, compare, conclude, contrast, defend, describe, discriminate, estimate, evaluate, explain, judge, justify, interpret, relate, predict, rate, select, summarize, support, value | making judgments based on internal evidence or external criteria |