| | other consequential responsibilities relevant to professional practice. |
|---|---|
| PO11 | **Individual & Team Work:** Ability to work as a member or leader in diverse teams in multidisciplinary environment. |
| PO12 | **Innovation and Entrepreneurship**: Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society. |

## Programme Specific Outcomes (PSOs)

| PSO 01 | Design, implement, populate and query the relational databases for operational data. |
|---|---|
| PSO 02 | Import and evaluate very large data sets to make business decisions. |
| PSO 03 | Execute real time analytical methods on streaming data sets to react quickly to customer needs. |
| PSO 04 | Mine data and carry out predictive modelling and analytics to support business decision making. |

## Course Objectives:

| COB1: | Provide knowledge on basics of data science, data analytics and its process. |
|---|---|
| COB2: | Make students understand various techniques for data pre-processing, and exploratory data analysis. |
| COB3: | Familiarize machine learning techniques for model building and solving real-world problems. |

## Course Outcomes:

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

| Sl. No. | Course Outcome | Description | Bloom's Taxonomy Level |
|---|---|---|---|
| 1. | CO1 | Describe data science and analytics, data science process and its applications. | L2 |
| 2. | CO2 | Choose various techniques to prepare data for analysis. | L3 |
| 3. | CO3 | Examine data using EDA. | L4 |
| 4. | CO4 | Develop models using machine learning techniques and modelling process. | L6 |
| 5. | CO5 | Assess models using techniques of model evaluation and selection. | L5 |

## Course Outcome Table:

| Course Outcomes | Skills | POs | Bloom's Taxonomy Level | Assessment Tools |
|---|---|---|---|---|
| CO1 | Understanding | PO1, PO2, PO7, PO9 | L2 | Examination, Presentation, Assignment |

| CO2 | Apply | PO1, PO2, PO3, PO4, PO5, PO7, PO9 | L3 | Examination, Assignment |
|------|---------|--------------------------------------------------------|-----|-------------------------------------|
| CO3 | Analyze | PO1, PO2, PO3, PO4, PO5, PO7, PO9, PO10 | L4 | Assignments, Discussion, Examination |
| CO4 | Create | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 | L6 | Assignments, Discussion, Examination |
| CO5 | Evaluate | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12 | L5 | Assignments, Discussion, Examination |

**CO-PO/PSO Mapping: (**3-Strong Correlation 2- Medium Correlation 1- Low Correlation)

| Course Outcomes | Blooms Taxonomy Level | Programme Outcomes (PO) | | | | | | | | | | | | Programme Specific Outcomes (PSO) | | | |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| | | PO 01 | PO 02 | PO 03 | PO 04 | PO 05 | PO 06 | PO 07 | PO 08 | PO 09 | PO 10 | PO 11 | PO 12 | PSO 1 L2 | PSO 2 L3 | PSO 3 L4 | PSO 4 L6 |
| CO1 | L2 | 3 | 2 | - | - | - | - | 1 | - | 1 | - | - | - | 3 | 1 | 1 | 1 |
| CO2 | L3 | 3 | 2 | 2 | 2 | 3 | - | 2 | - | 2 | - | - | - | 3 | 2 | 1 | 1 |
| CO3 | L4 | 3 | 3 | 3 | 2 | 2 | - | 2 | - | 1 | 1 | - | - | 3 | 3 | 2 | 2 |
| CO4 | L6 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 |
| CO5 | L5 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 3 | 3 | 2 | 2 |

**Course Contents:**

| Module | Details | Contact Hours |
|--------|---------|---------------|
| I | **Introductory Concepts** <br> Overview of Data Science and Data Analytics, Types of Analytics: Descriptive, Diagnostics, Predictive and Prescriptive; Data Ubiquity, Nature of Data: Structured, Unstructured, Big Data; Advantages of Data-Driven Decisions, Data Science Process, Applications of Data Science in various fields, Data Science Roles, Data Security, Privacy, and Ethical Issues. | 12 |
| II | **Data Preparation** <br> Data Collection Methods: Primary, Secondary data; Pre-Processing: Data Cleaning, Data Integration and Transformation, Data Discretization; Dimensionality Reduction, PCA, Feature Engineering and Selection. | 12 |
| III | **Exploratory Data Analysis** <br> What is Exploratory Data Analysis (EDA)? Descriptive Statistics: Mean, | 12 |

| | | Standard Deviation, Skewness and Kurtosis; Types of EDA: Univariate, Bi-Variate, Multi-Variate; Visualizing EDA: Histogram, Scattered Plot, Box Plots, Pivot Table, Heat Map; Correlation Statistics, Statistical Significance and Hypothesis Testing, ANOVA. | |
|---|---|---|---|
| IV | **Machine Learning and Model Building** Machine Learning in Data Science, Types of Machine Learning, Supervised, Unsupervised, Modelling Process, Simple and Multiple Regression, Time Series Analysis, Classification, Prediction, Clustering, Decision Tree, k-Nearest Neighbour, Association Rules Mining. | 12 |
| V | **Model Evaluation** Model Accuracy, Overfitting, Under Fitting, Bias-Variance Trade-off, Evaluation Metrics, Confusion Metrix, Methods for evaluating Accuracy, Cross Validation, Model Evaluation using Visualization: Residual Plot, Distribution Plot, ROC curve, Model Selection. | 12 |

## Text Book (TB):

1. A General Introduction to Data Analytics, by João Moreira, Andre Carvalho, Tomás Horvath, Wiley, ISBN: 978-1-119-29626-3 June 2018.

## Reference Books (RB):

1. Introducing Data Science, by Davy Cielen, Arno D. B. Meysman, Mohamed Ali, Manning Publications, 2016
2. Data Science for Business, by Foster Provost and Tom Fawcett, O'Reilly, 2013.
3. Data Science and Big Data Analytics by EMC Education Services (Editor), Wiley, 2015
4. Doing Data Science by Rachel Schutt and Cathy O'Neil, O'Reilly, 2014
5. Practical Statistics for Data Scientists by Peter Bruce and Andrew Bruce, O'Reilly, 2017.

## Web Video Links:

1. https://www.linkedin.com/learning/data-science-foundations-fundamentals-5/the-fundamentals-of-data-science?autoAdvance=true&autoSkip=false&autoplay=true&resume=false&u=92695330

2. https://www.linkedin.com/learning/introduction-to-data-science-2/beginning-your-data-science-exploration?autoAdvance=true&autoSkip=false&autoplay=true&resume=true&u=92695330

3. https://www.linkedin.com/learning/paths/master-excel-for-data-science

## Web Text Links:

1. https://towardsdatascience.com/the-evolution-of-data-science-as-i-remember-it-54cf4e602bd5

| Abbreviations & Expansions | | | | |
|---|---|---|---|---|
| **Pedagogy/Activity planned** | | | **Mode of Delivery** | |
| **P1** | PPT presentation & Classroom interaction | | **M1** | Synchronous – PPT |
| **P2** | Blended Learning with Hands on | | **M2** | Asynchronous / synchronous |
| **P3** | Flip Class & Module Quiz | | **M3** | Synchronous - Hands on |