UNIVERSITY ⚜ OF MYSORE
Estd.1916

Vishwavidyanilaya Karyasoudha
Crawford Hall, Mysuru- 570 005

(Re-accredited by NAAC with 3.01 CGPA of 4.0 Scale)
(NIRF-2021 Ranked 19 in University Category & 34 in Overall Category)

No.: PMEB/AC10/759(5)/2019-20   Date: 10-01-2022

NOTIFICATION

Sub.: Introduction of **Certificate Course in Data Science, Certificate Course in Machine Learning with Python Programming, Certificate Course in Digital Health** courses under Specialized Programmes from the academic year 2021-22-reg.

Ref.: 1. Decision of the BOS Meeting held on 06-12-2021.
   2. Decision of the Faculty of Science & Technology meeting held on 20-12-2021.
   3. Decision of the Academic Council meeting held on 23-12-2021.

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The Board of Studies in **Certificate Course in Data Science, Certificate Course in Machine Learning with Python Programming, Certificate Course in Digital Health (UG)** at its meeting held on 06-12-2021 has recommended to introduce **Certificate Course in Data Science, Certificate Course in Machine Learning with Python Programming, Certificate Course in Digital Health** courses in University of Mysore under specialized/specified programs. The Regulations, Syllabus and Scheme of Examination was approved from the academic year 2021-22.

The Faculty of Science & Technology and the Academic Council at their meetings held on 20-12-2021 and 23-12-2021 respectively, are also approved the above said proposals and the same is hereby notified.

The Regulations, Syllabus and Scheme of Examination of **Certificate Course in Data Science, Certificate Course in Machine Learning with Python Programming, Certificate Course in Digital Health** courses is uploaded in University website. The contents may be downloaded from the University website **https://uni-mysore.ac.in/PMEB/**.

REGISTRAR
REGISTRAR
University of Mysore
MYSURU - 570 005

To;
1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Dean, Faculty of Science & Technology, DOS in Earth Science, Manasagangothri, Mysuru.
3. Prof. H.S. Nagendraswamy, DOS in Computer Science, Manasagangotri, Mysuru.

P.T.O...

4. The Founder Trustee, iPEC Edutech (iPEC Foundation), MIT Campus, 2nd Floor, Belavadi, Srirangapatna Tq., Mandya Dist.
5. The Deputy Registrar/ Asst. Registrar/ Superintendent, Examination Branch, UOM, Mysuru.
6. The Special Officer to Hon'ble Vice-Chancellor, University of Mysore, Mysuru.
7. The PA to Vice-Chancellor/Registrar/Registrar (Evaluation), University of Mysore, Mysuru.
8. Office Copy.

Programme Description

Digital Health Certification

Digital Health is a convergence of technologies designed to improve healthcare delivery and outcomes, engage patients, expand evidence-based research, create and mine new data sources, and support positive health behaviors. These are applied through hardware, software and analytics-enabled solutions that can be delivered virtually through the internet or other means of transmission. Digital Health has rapidly become a multi-disciplinary domain involving healthcare providers, behavioral psychologists, data scientists, technologists, implementation scientists, engineers, designers, social scientists, as well as participants from public health, health economics and healthcare management disciplines.

This course is a perfect blend of theory, hands on, case studies and capstone projects. The course curriculum has been designed by experts from both academia and industry. Get noticed by recruiters across the globe with the UoM certification.

Programme Outcome

The course introduces students to fundamental knowledge about the drivers of healthcare transformation, methods, and technologies in the digital transformation of healthcare. Including content in Healthcare Transformation, Digitalization of Healthcare, Data-driven methods and tools, and enabling Medical Technology.

On completion of the course, the student should be able to:

- Motivate the need for transformation in the current healthcare system.
- Recognized emerging digital technologies and understand their impact in the workplace.
- Demonstrate a basic understanding of the role of digitalization in such a transformation process.
- Analyze real cases of digital health transformation Skills and abilities
- Critically identify the opportunities and barriers for adoption of digital tools in a care environment
- Recognize the contribution of medical technologies in digital health transformation

REGULATIONS AND CURRICULUM

1. **Duration:**   6 months
2. **Number of Programmes:**   One
3. **Total Number of Courses:** 3
4. **Total Number of Credits:** 10
5. **Total Number of Hours:**   280 Hours

The total number of Hours include theory / tutorials/ Case Study and Project work as required / applicable to each course depending on the content / approach by the faculty

6. **Scheme:**   Certificate Course (Digital Health)

7. **Intake:**   Maximum 40

8. **Entry Level**

The eligibility for admissions to the course shall be governed in accordance with the rules framed by the University of Mysore from time to time. The eligibility criteria for admission to the certificate program in ML with python programming shall be pass in:
PUC or 10+2 or Diploma from any Discipline
.
9. **Scheme of the Program**

The duration of the certificate course shall be six months inclusive of the days of examinations.

10. **Continuous Assessment**

Assessment and evaluation process happen in a continuous mode. However, for the purpose of reporting, a course is divided into discrete components identified as C1: Quizzes, C2: Case Study, C3: Programming Test, C4: Project work, C5: Final Exam.

10.1 Outline for continuous assessment activities for C1, C2, C3, C4 will be proposed by the faculty in-charge.

10.2 The first component C1 (quiz) is for **10%**. C1 will be conducted by the faculty handling the subject after every module.

10.3. The second component C2 (case study) is for **10%**. Topic will be assigned to the student for the case study, student has to conduct a survey via online/offline sources and should submit a case study report.

10.4 The third component is C3 (programming test) is for **10%**. Set of questions will be provided to the students to solve the problems using Python programming on the spot.

10.5 The fourth component C4 (project work) is for **20%**. Group activity; a topic is assigned to each group along with the guidelines and report template. Every group has to complete the projects in allotted time frame with demo and presentation. The project supervisor or faculty in charge will be evaluating the work for 20 marks.

11. Attendance

a.   75% Attendance is mandatory for the student in Course to appear for C5 Exam.

b.   In case a candidate secures less than 30% in C1, C2, C3, and C4 put together in a course, the candidate is said to have DROPPED the course and is not allowed to appear for C5 in the course.

c.   In case a candidate secures less than 30% in C5, he/she may choose DROP / Re-Take Exam Option.

12. Evaluation

12.1. Students will be evaluated for each activity mentioned above by the faculty handling that course.

12.2. After the evaluation, the results have to be announced. The course teacher has to obtain the signatures of the students in a prescribed format, indicating that they have no objection to the marks awarded within 5 days from the date of announcement of the marks.

12.3. In case of student is not satisfied with assessment, the student can make an appeal to the course coordinator or Board of Studies. Decision taken by them will be the final.

13. Examination And Evaluation

13.1. For the Final examination with all one component only Theory T: CT, the C5 paper will be set for 50 marks.

<div align="center">

C5 marks = CT

</div>

13.2. Question Paper Pattern and Setting
a) The question paper pattern for C5 component of course will comprise of objective type of questions for 10 marks, descriptive for 20 marks and programming related questions for 20 marks. The same pattern shall be prepared by the faculty from iPEC EduTech. It will be scrutinized and approved by the respective Board of Studies.

b) Valuation.

Before the valuation the answer scripts shall be coded.
There shall be centralized, single valuation of the C5 theory answer scripts

13. Passing Criteria

14.1 A student is considered to have passed the course, only on securing a minimum of 40% from C1, C2, C3, C4, and C5 put together.

14.2. A student can take C5 exam irrespective of the marks scored in c1, c2, c3, and c4.

14.3. In case a student secures less than 30% in C5 or absent for C5, the student is said to have not completed the course. The student shall complete the course by re-appearing only for c5 component of that course when university conducts the examination. The student carries the marks already awarded in C1, C2,C3 and C4.

13.4. On successful completion of program, a final grade card consisting of grades scored by the student and certification will be issued by the University of Mysore.

14. Percentage And Grading

If M is the marks secured by a candidate in a course which is rounded to the nearest integer, the grade G, earned by the student in a course will be as given below.

Marks (M)	Grade (G)
40-49	5.0
50-59	6.0
60-64	6.5
65-69	7.0
70-74	7.5
75-79	8.0
80-84	8.5
85-89	9.0
90-94	9.5
95-100	10.0

15. Class Declaration
The Final Qualitative Index to be awarded to the student is based on CGPA. It is given as:

Grade	Qualitative Index
$5 \leq$ Grade ≤ 6	Grade B
$6 \leq$ Grade ≤ 8	Grade A
$8 \leq$ Grade ≤ 10	Grade A+

16. Conduct
Every student is required to observe discipline and decorum both inside and outside of the class room, in accordance with the instructions of the institute and also as per the instructions issued by the University of Mysore/ Government of Karnataka / UGC from time to time regarding Student Conduct Rules.

17. Nature of the Course

The pattern of the courses is as under: -

18.1 Medium of instruction shall be English.

18.2 The Program is Add-on course

18.3 Total marks will be 100, (50 from continuous evaluation and 50 from Final Exam).

CURRICULUM & COURSE STRUCTURE

SL NO	TITLE OF THE SUBJECT	L+T+P	CREDIT
1.	Principles of Digital Health	2:1:0	3
2.	Digital Health Technologies and Systems	2:1:0	3
3.	Machine learning for healthcare	2:1:1	4
	TOTAL	6:6:2	10

Detailed Syllabus for Digital Health

Course-1: **Principles of Digital Health**   (2:1:0)

1. Introduction to Digital Health   (10 Hours)
  ➢ Overview of Healthcare System
  ➢ Types of Healthcare Information Systems
  ➢ Interoperability of Digital Health systems
  ➢ International and Indian Digital Health Standards
  ➢ Ethics and Security, Privacy and Trust

2. Principles of Digital Health   (10 Hours)

- ➢ Clinical Decision Support and Registries
- ➢ Terminologies and Enterprise Architecture
- ➢ Applications of Health IT standards
- ➢ Data Protection

3. Health System Transformation   (10 Hours)
- ➢ Quality Improvement and Health Service Development
- ➢ Digital Technologies for Health System Transformation
- ➢ Theories of Informatics in the Design and Implementation of Information Systems
- ➢ Recording, Analyzing and Interpreting Data
- ➢ Future Digital Health Technologies

4. Health Projects   (10 Hours)
- ➢ The Major Health IT Projects
- ➢ Usability of Digital Health Systems
- ➢ Investment, Innovation and Entrepreneurship in DH
- ➢ Digital Health Project Management

Course-2: **Digital Health Technologies and Systems (**2:1:0)

1. Introduction   (10 Hours)
- ➢ Digital health apps
- ➢ Wearable Sensors for health monitoring
- ➢ Smart Systems
- ➢ Technology to Impact Healthcare
- ➢ Explore the multidisciplinary trends shaping the future of health care

2. Medical Data andits Importance   (10 Hours)
- ➢ Data Collection and Analysis
- ➢ Data in healthcare
- ➢ Challenges
- ➢ How data is being used
- ➢ Key features of qualitative and quantitative data analysis

➢ Basic principles of data interpretation

3. AI in Healthcare   (10 Hours)
➢ Motivating AI in healthcare
➢ Skills required to enable AI in healthcare
➢ Using machine learning for treatment
➢ Conversational AI
➢ Using AI to Efficiently Diagnose and Reduce Error
➢ An intelligent symptom checkers
➢ Treating rare disease with AI
➢ AI, cloud-based digital drug discovery
➢ Neural network for clinical trials

4. Benefits of Digital Health Systems   (10 Hours)
➢ Responsive and sustainable healthcare
➢ Prevention before treatment
➢ Re-modeling the patient-doctor relationship
➢ Design of Usable Health and Care Systems

Course-3: **Machine learning for healthcare (**2:1:1)

1. Overview of ML in Healthcare   (10 Hours)
➢ Why machine learning in healthcare?
➢ History of AI in Medicine
➢ Why Healthcare Needs Machine Learning
➢ Machine Learning Magic
➢ Machine Learning, Biostatistics, Programming
➢ Concepts and Principles of machine learning in healthcare

2. Classification of Diseases & Disorders   (10 Hours)

2.1 Basics of classification algorithms
➢ Classification task
➢ Algorithms for classification
➢ Evaluation of results
➢ Interpretation of algorithm results

2.3 Classify normal and disease data

- ➢ Heart Diseases
- ➢ Cancer
- ➢ Diabetes
- ➢ Thyroid Diseases
- ➢ Other Diseases
- ➢ Voice
- ➢ Vision
- ➢ Speech

3. Clustering Algorithm for Disease Modelling (10 Hours)

3.1 Introduction to clustering
- ➢ Definition
- ➢ Types of clustering
- ➢ Steps to perform clustering
- ➢ Top Clustering Applications

3.2 ML algorithms for clustering
- ➢ K-Means for Parkinson's Disease data
- ➢ Expectation Maximization for speech data
- ➢ Self-Organizing Map for Cardio vascular disease

4. Prediction of Diseases and Severity   (10 Hours)

4.1 Basics of prediction task
- ➢ Prediction Model
- ➢ Flow of data
- ➢ Algorithms for prediction
- ➢ Performance Evaluation

4.2 Perform Predictions
- ➢ Logistic Regression
- ➢ Random Forest
- ➢ Decision Tree

Capstone Projects related to medical Data:

- ➢ Appointment Scheduling
- ➢ waveform Analysis (ECG/PPG)
- ➢ Resource Allocation
- ➢ Extracting features from images & Speech

> ➢ Disease detection & Classification
> ➢ Disorder Prediction etc.

Case Studies:

1. Case study to examines how the impact of the Covid-19 pandemic has exposed cracks in the way systems deliver healthcare and how this has made way for new types of thinking about healthcare which are vital in a post pandemic world.

2. In-hospital patient monitoring using IoT

3. Precision Medicine

4. Elderly care using AI

5. Machine learning Models for Tracking and monitoring of patients.

6. Forecasting models in wellness and fitness

Text Books:

1. Digital Health: Mobile and Wearable Devices for Participatory Health Applications 1st Edition - November 14, 2020

2. A Virtual Care Blueprint:How Digital Health Technologies Can Improve Health Outcomes, Patient Experience, and Cost Effectiveness By Robert Longyear, Copyright Year 2022

3. AI in Health: A Leader's Guide to Winning in the New Age of Intelligent Health Systems (HIMSS Book Series) Paperback – Illustrated, 12
4. February 2020 by Tom Lawry

5. The Digital Health Revolution by Kevin Pereau(January 2019)

6. Digital Health: Truly Transformational by Rajendra Pratap Gupta (1 Feb 2021)

7. Digital Health Communications by Benoit Cordelier and Olivier Galibert 1st edition (7 July 2021)

8. Roadmap to Successful Digital Health Ecosystems: A Global Perspective by Evelyn Hovenga and Heather Grain 1st Edition

9. The Digital Reconstruction of Healthcare: Transitioning from Brick and Mortar to Virtual Care by Paul Cerrato and John Halamka (June 8, 2021)

10. Digital Health: Changing the Way Healthcare Is Conceptualized and delivered by Informatics) by Elizabeth Cummings , Mark Merolli , Louis K. Schaper (1 August 2019)

Question Paper pattern

Duration: 02 Hours
Maximum Marks: 50

The final examination, component C5 is to be conducted for 50 marks, which includes objective for 10 marks and descriptive type of questions for 40 marks. The question paper will have two sections Part-A and Part-B.
Part-A is compulsory, comprising objective type, each question carries 1 mark. In Part-B choice will be provided for the student to select any 4 complete question and write descriptive answer, each question carries 10 marks.

Programme Description

Data Science Certification

Accelerate your career with Data Science certification from India's premiere Government University (UoM) with its headquarters at Mysore, Mysore a city of palaces; is also a prominent academic Centre, with institutions ranging from traditional Ayurveda to modern medical sciences, business management to engineering, law to commerce. UoM is 105 years old University in India as of 2021, comprising 122 affiliated colleges and five constituent colleges, there are approximately 53,000 students studying at the university.

Data science is an interdisciplinary field that use scientific methods, procedures, algorithms, and systems to extract knowledge and insights from noisy, structured, and unstructured data, as well as to apply that knowledge and actionable insights to a variety of application areas.

This course is a perfect blend of theory, hands on, case studies and capstone projects. The course curriculum has been designed by experts from both academia and industry. Get noticed by recruiters across the globe with the UoM certification.

Program Outcome

- ➢ These program objectives acknowledge the interdisciplinarity of data science and the importance of building a strong foundation with our students.
- ➢ Expose students to real-world problems in the classroom and through experiential learning.
- ➢ Apply mathematical principles to the analysis of data
- ➢ Analyze very large data sets in the context of real world problems
- ➢ Develop and implement data analysis strategies base on theoretical principles, ethical considerations, and detailed knowledge of the underlying data

REGULATIONS AND CURRICULUM

1. Duration: 6 months
2. Number of Programmes: One
3. Total Number of Courses: 4
4. Total Number of Credits: 10
5. Total Number of Hours: 440 Hours

The total number of Hours include theory / tutorials/ Case Study and Project work as required / applicable to each course depending on the content / approach by the faculty

6. Scheme: Certificate Course (Data Science)

7. Intake: Maximum 40

8. Entry Level

The eligibility for admissions to the course shall be governed in accordance with the rules framed by the University of Mysore from time to time. The eligibility criteria for admission to the certificate program in ML with python programming shall be pass in:
PUC or 10+2 or Diploma from any Discipline
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18.2 The Program is Add-on course

18.3 Total marks will be 100, (50 from continuous evaluation and 50 from Final Exam).

CURRICULUM & COURSE STRUCTURE

SL.NO	TITLE OF THE SUBJECT	L+T+P	CREDIT
1.	Python Programming	2:1:1	4
2.	Mathematics	2:1:0	3
3.	Data Analysis Tools	2:1:1	4
4.	Machine Learning	2:1:1	4
	TOTAL	**8:8:6**	**15**

Detailed Syllabus for Data Science

Course-1: **Python Programming** (2:1:1) (40 Hours)

UNIT-1: Essentials of Python Programming (10 Hours)

1.1 Python Basics
- Installing
- What is Python and Why Python?
- History and Philosophy of Python
- Python versions
- The Interpreter, an Interactive Shell
- Execute a Script
- Structuring with Indentation
- Data Types and Variables
- Types of Operators
- Python Operators Precedence

1.2 Decision Making Statements
- Importance of Decision Making
- Single Statement Suites
- Conditional Statements in Real Life
- Combining Statements into Blocks
- if condition
- if-else &elif
- Ternary if Statement

1.3 Loops
- Loop Type & Description
- General Structure of a Loop
- Premature Termination of a while Loop
- Entry condition & Exit Condition

UNIT 2: Data Structures / Containers (10 Hours)

2.1 List
- List Notation and Examples
- Properties of List
- Creation of List
- Assigning Values
- Basic List Operations
- Sublists
  - Slicing
  - Built-in functions of List

2.2 String
- String Creation

- ➢ Accessing Values in Strings
- ➢ Updating Strings
- ➢ Escape Characters
- ➢ String Special Operators
- ➢ String Formatting Operator
- ➢ Triple Quotes
- ➢ Built-in String Methods

2.3 Dictionary
- ➢ Creation of Dictionary
- ➢ Properties of Dictionary Keys
- ➢ Accessing Values in Dictionary
- ➢ Updating Dictionary
- ➢ Delete Dictionary Elements
- ➢ Built-in Dictionary Functions & Methods

2.4 Functions
- ➢ Defining a Function
- ➢ Calling a Function
- ➢ Pass by reference vs value
- ➢ Function Arguments

UNIT 3: NumPy   (10 Hours)
- ➢ Arrays
- ➢ Array indexing
- ➢ Datatypes
- ➢ Array math
- ➢ Broadcasting
- ➢ NumPy Documentation
- ➢ Buit-in Methods
- ➢ Built-in Functions
- ➢ Solving Problems

UNIT 4: Pandas   (10 Hours)
- ➢ Pandas Introduction
- ➢ Pandas Series
- ➢ Pandas Data Frames
- ➢ Pandas Read CSV
- ➢ Pandas Analyzing Data
- ➢ Pandas Visualization
- ➢ Advanced Pandas

Python Practicals

LIST OF LAB ASSIGNMENTS

1   Print the sum of the current number and the previous number

2   Print characters from a string that are present at an even index number

3   Check if the first and last number of a list is the same

4   Print multiplication table from 1 to 10

5   Make a two-player Rock-Paper-Scissors game. (Hint: Ask for player plays (using input), compare them, print out a message of congratulations to the winner, and ask if the players want to start a new game)
    - o   Remember the rules:
    - o   Rock beats scissors
    - o   Scissors beats paper
    - o   Paper beats rock

6   Write a Program for checking whether the given number is an even number or not. Using a for loop.

7   Write a program to count the numbers of characters in the string and store them in a dictionary data structure Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.

8   Write a program to use split and join methods in the string and trace a birthday of a person with a dictionary data structure.

9   Write function to compute GCD, lcm of two numbers.

10 Write a program to implement Merge sort/ Selection sort/ Insertion sort

Course-2: **MATHEMATICS** (2:1:0)   (30 Hours)

UNIT-1: Linear Algebra (8 Hours)

1.1 Linear Algebra
- Motivation – Why learn Linear Algebra?
- Representation of problems in Linear Algebra
- Visualizing the problem: Line
- Systems of linear equations and matrices
- Linear Transformations

1.2 Matrices and Set Theory
- Terms related to Matrix
- Basic operations on Matrix
- Representing in Matrix form
- Sets
- Cardinality
- Intersection
- Union
- Venn Diagrams & the Inclusion-Exclusion Formula
- Transpose of a matrix
- Inverse of a matrix
- Determinant of a matrix
- Trace of a matrix
- Dot product

UNIT-2: Models Score and Error (8 Hours)
- Mean Absolute Error(MAE)
- Mean Squared Error (MSE)
- Error Analysis and Tradeoffs
- Residuals and Classification Results
- Model Performance Overview
- Confusion matrix
- Precision
- Recall
- Specificity
- Accuracy
- Lift
- Area under the ROC curve (AUC)
- F-score
- Log-loss
- Average precision
- Precision/recall break-even point
- Goodness-of-fit metrics
- Bias

UNIT-3: STATISTICAL METHODS-1 (7 Hours)

Probability:

Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Bayes' Theorem and independence, problems.

Random Variables:

Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality.

UNIT-4: STATISTICAL METHODS-2   (7 Hours)

Sampling Distributions:

The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions, problems.

Testing of Hypotheses:

Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chisquare goodness of fit test and its
applications, problems.

Textbooks

1. An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md.E.Saleh.

2. Introduction to Probability and Statistics by J.S. Milton &J.C.Arnold.

3. Introduction to Probability Theory and Statistical Inference by H.J. Larson.

4. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross

5. A First Course in Probability by S.M. Ross 6. Probability and Statistics in Engineering by W.W. Hines, D.C. Montgomery, D.M. Gpldsman&C.M.Borror

Course-3: **DATA ANALYSIS TOOLS** (2:1:1) (40 Hours)

UNIT-1: EXCEL   (10 Hours)

1.1 Introduction to Spreadsheets:

- Reading data into Excel using various formats
- Basic functions in Excel, arithmetic as well as various logical functions.
- Formatting rows and columns
- Using formulas in Excel and their copy and paste using absolute and relative referencing

1.2   Spreadsheet Functions to Organize Data:

- IF and the nested IF functions
- VLOOKUP and HLOOKUP
- The RANDBETWEEN function

1.3   Introduction to Filtering, Pivot Tables, and Charts

- Data filtering in Excel
- Use of Pivot tables with categorical as well as numerical data
- Introduction to the charting capability of Excel

1.4   Advanced Graphing and Charting

- Line, Bar and Pie charts
- Pivot charts
- Scatter plots and Histogram

UNIT-2: Sentimental Analysis using NLP   (10 Hours)

- Text Analytics - Basics
- Web Scraping for fetching data from Wikipedia
- Analyzing text statistics
- Ngram exploration
- Topic modeling exploration with pyLDAvis
- Wordcloud
- Sentiment analysis

UNIT-3: Power BI   (10 Hours)

3.1 Understand the Power Bi Ecosystem
➢ Describe the Power BI ecosystem
➢ Define Power BI and its relationship with Excel
➢ Discuss the Power BI suite of products
➢ Describe how the Power BI products integrate
➢ Explain the typical analytics process flow

3.2 Design A Power Bi Data Model
➢ Describe the Power BI ecosystem
➢ Define Power BI and its relationship with Excel
➢ Discuss the Power BI suite of products
➢ Describe how the Power BI products integrate
➢ Explain the typical analytics process flow

3.3 Create & Format Visualizations using the Power Bi Service
➢ Build additional reports in the Power BI Service
➢ Compile and configure reports into a Dashboard
➢ Construct a Power BI Mobile dashboard
➢ Add a Quick Insights results to a report
➢ Implement and use Q&A visual

UNIT-4: Tableau   (10 Hours)

➢ Introduction
➢ Connecting to data
➢ Simplifying and sorting your data
➢ Organizing your data
➢ Slicing your data by date
➢ Using multiple measures in a view
➢ Showing the relationship between numerical values
➢ Mapping data geographically
➢ Viewing specific values
➢ Customizing your data
➢ Analyzing data with quick table calculations
➢ Showing breakdowns of the whole
➢ Highlighting data with reference lines
➢ Making your views available

Course-4: MACHINE LEARNING (2:1:1)   (40 Hours)

UNIT-1: Foundation of Machine Learning   (6 Hours)

- ➢ Introduction to Machine Learning
- ➢ Feature Engineering
- ➢ Supervised Regression
- ➢ Linear Regression - Model building & Fine Tuning
- ➢ Model Deployment

UNIT-2: Supervised Models   (12 Hours)
- ➢ K-Nearest Neighbours
- ➢ Decision Trees
- ➢ Ensemble Techniques
- ➢ Naive Bayes

UNIT-3: Unsupervised Models   (10 Hours)

- ➢ Clustering Techniques
- ➢ K-means Algorithm
- ➢ Dimensionality Reduction

UNIT-4: Time Series Analysis   (12 Hours)

- ➢ What is Time-Series Analysis?
- ➢ Implementing Time-series Analysis in ML
- ➢ ML Models and Methods in Time-Series Analysis
- ➢ Moving Average
- ➢ Time Series Forecasting
- ➢ ARIMA Model

CAPSTONE PROJECTS

1. Customer Analysis and segmentation
2. Credit card Fraud detection and risk Assessment
3. Rainfall prediction
4. Yahoo finance live share market data Analysis and prediction
5. Movielens project
6. Demand prediction of driver availability using multistep Time Series Analysis
7. Exploratory Data Analysis-EDA on Iris Data
8. EDA on Cryptocurrency Dataset
9. EDA on COVID-19 Dataset
10. EDA on Goldprice

CASE STUDY

1. Sports Analytics- FIFA World Cup analysis
2. Voice Assistants
3. Text Emotions Detection

4. Hotel Recommendation System
5. Customer Personality Analysis
6. Python Programming
7. Natural Calamity Risk Analysis
8. Sales Analytics-Analyzing Drop in User Engagement
9. IoT Analytics-Fitbit
10. Retail Analytics-shopping mall
11. Marketing Analytics-Dominos / Swiggy
12. Pricing Analytics-Ace Hardware
13. Edge Analytics-Agriculture
14. Healthcare Analytics-Hospital Resource Management
15. HR Analytics: to curb attrition in a IT Company

TEXTBOOKS

➢ Business Intelligence, Analytics, and Data Science: A Managerial Perspective, Fourth Edition, By Pearson paperback-25 march 2019 by Ramesh Shrada, DursunDelen, Efraim Turban.

➢ Data Science For Business Professionals: A Practical Guide For Beginners: A Practical Guide for Beginners (English Edition) Paperback – 1 January 2020 .

➢ Data Mining &Bussiness Intelligence 1 Edition (English, Paperback, Vivek Bhambri, Babita Chopra, Balram Krishan)

➢ Python for Data Science For Dummies, 2ed Paperback – 1 January 2019 by Luca Massaron John Paul Mueller.

Question Paper pattern

Duration: 02 Hours
Maximum Marks: 50
The final examination, component C5 is to be conducted for 50 marks, which includes objective for 10 marks and descriptive type of questions for 40 marks. The question paper will have two sections Part-A and Part-B.Part-A is compulsory, comprising objective type, each question carries 1 mark. In Part-B choice will be provided for the student to select any 4 complete question and write descriptive answer, each question carries 10 marks.

Programme Description

Machine Learning using Python Programming Certification

Machine learning employment are expected to be worth around $31 billion globally by 2025. This represents a rising trend of ML usage in different sectors. These figures highlight the demand for machine learning skills, and if you're ready to put in the effort, you may be on your way to a rewarding new profession.

Keeping this need in mind, the iPEC EduTech (iPEC Foundation) has designed the Certificate Program in Machine Learning with Python Programming to upskill and train students or professionals in the world's most in-demand technology to stand out from the crowed.

The certificate of completion will be awarded by the Karnataka's prestigious Govt University "University of Mysore (UoM)". This enhances the prospects for the successful students.

This course is a perfect blend of theory, hands on, case studies and capstone projects. The course curriculum has been designed by experts from both academia and industry. Get noticed by recruiters across the globe with the UoM certification.

Program Outcome

➢ These program objectives acknowledge the interdisciplinarity of data science and the importance of building a strong foundation with our students.

➢ Expose students to real-world problems in the classroom and through experiential learning.

➢ Apply mathematical principles to the analysis of data

➢ Analyze very large data sets in the context of real world problems

➢ Develop and implement data analysis strategies base on theoretical principles, ethical considerations, and detailed knowledge of the underlying data

REGULATIONS AND CURRICULUM

1. **Duration:** 6 months
2. **Number of Programmes:** One
3. **Total Number of Courses:** 2
4. **Total Number of Credits:** 10
5. **Total Number of Hours:** 280 Hours

The total number of Hours include theory / tutorials/ Case Study and Project work as required / applicable to each course depending on the content / approach by the faculty

6. **Scheme:** Certificate Course (MLP)

7. **Intake:** Maximum 40

8. **Entry Level**

The eligibility for admissions to the course shall be governed in accordance with the rules framed by the University of Mysore from time to time. The eligibility criteria for admission to the certificate program in ML with python programming shall be pass in:

PUC or 10+2 or Diploma from any Discipline
.

9. **Scheme of the Program**

The duration of the certificate course shall be six months inclusive of the days of examinations.

10. **Continuous Assessment**

Assessment and evaluation process happen in a continuous mode. However, for the purpose of reporting, a course is divided into discrete components identified as C1: Quizzes, C2: Case Study, C3: Programming Test, C4: Project work, C5: Final Exam.

10.1 Outline for continuous assessment activities for C1, C2, C3, C4 will be proposed by the faculty in-charge.

10.2 The first component C1 (quiz) is for **10%**. C1 will be conducted by the faculty handling the subject after every module.

10.3. The second component C2 (case study) is for **10%**. Topic will be assigned to the student for the case study, student has to conduct a survey via online/offline sources and should submit a case study report.

10.4 The third component is C3 (programming test) is for **10%**. Set of questions will be provided to the students to solve the problems using Python programming on the spot.

10.5 The fourth component C4 (project work) is for **20%**. Group activity; a topic is assigned to each group along with the guidelines and report template. Every group has to complete the projects in allotted time frame with demo and presentation. The project supervisor or faculty in charge will be evaluating the work for 20 marks.

11. Attendance

a. 75% Attendance is mandatory for the student in Course to appear for C5 Exam.

b. In case a candidate secures less than 30% in C1, C2, C3, and C4 put together in a course, the candidate is said to have DROPPED the course and is not allowed to appear for C5 in the course.

c. In case a candidate secures less than 30% in C5, he/she may choose DROP / Re-Take Exam Option.

12. Evaluation

12.1. Students will be evaluated for each activity mentioned above by the faculty handling that course.

12.2. After the evaluation, the results have to be announced. The course teacher has to obtain the signatures of the students in a prescribed format, indicating that they have no objection to the marks awarded within 5 days from the date of announcement of the marks.

12.3. In case of student is not satisfied with assessment, the student can make an appeal to the course coordinator or Board of Studies. Decision taken by them will be the final.

13. Examination And Evaluation

13.1. For the Final examination with all one component only Theory T: CT, the C5 paper will be set for 50 marks.

$$C5\ marks = CT$$

13.2. Question Paper Pattern and Setting
a) The question paper pattern for C5 component of course will comprise of objective type of questions for 10 marks, descriptive for 20 marks and programming related questions for 20 marks. The same pattern shall be prepared by the faculty from iPEC EduTech. It will be scrutinized and approved by the respective Board of Studies.

b) Valuation.

Before the valuation the answer scripts shall be coded.

There shall be centralized, single valuation of the C5 theory answer scripts

14. Passing Criteria

14.1 A student is considered to have passed the course, only on securing a minimum of 40% from C1, C2, C3, C4, and C5 put together.

14.2. A student can take C5 exam irrespective of the marks scored in c1, c2, c3, and c4.

14.3. In case a student secures less than 30% in C5 or absent for C5, the student is said to have not completed the course. The student shall complete the course by re-appearing only for c5 component of that course when university conducts the examination. The student carries the marks already awarded in C1, C2,C3 and C4.

14.4. On successful completion of program, a final grade card consisting of grades scored by the student and certification will be issued by the University of Mysore.

15. Percentage And Grading

If M is the marks secured by a candidate in a course which is rounded to the nearest integer, the grade G, earned by the student in a course will be as given below.

Marks (M)	Grade (G)
40-49	5.0
50-59	6.0
60-64	6.5
65-69	7.0
70-74	7.5
75-79	8.0
80-84	8.5
85-89	9.0
90-94	9.5
95-100	10.0

16. Class Declaration
The Final Qualitative Index to be awarded to the student is based on CGPA. It is

given as:

Grade	Qualitative Index
5 ≤ Grade ≤ 6	Grade B
6 ≤ Grade ≤ 8	Grade A
8 ≤ Grade ≤ 10	Grade A+

17. Conduct

Every student is required to observe discipline and decorum both inside and outside of the class room, in accordance with the instructions of the institute and also as per the instructions issued by the University of Mysore/ Government of Karnataka / UGC from time to time regarding Student Conduct Rules.

18. Nature of the Course

The pattern of the courses is as under: -

18.1 Medium of instruction shall be English.

18.2 The Program is Add-on course

18.3 Total marks will be 100, (50 from continuous evaluation and 50 from Final Exam).

CURRICULUM & COURSE STRUCTURE

SL.NO	TITLE OF THE SUBJECT	L+T+P	CREDIT
1.	Python Programming	2:1:1	4
2.	Machine Learning	4:1:1	6
	TOTAL	6:2:2	10

SYLLABUS

COURSE 1: PYTHON PROGRAMMING (2:1:1) (40 HOURS)

UNIT-1: Fundamentals of Python Programming   (10 Hours)

1.1   Installation of Python Software

- How to Download and Install Python
- Install Python with Diff IDEs
- Setting up the Environment for programming
- Introduction to the course
- General computer programming concepts
- Program Structure
- System Software responsible for running program

1.2 Importance of Language

- What is Python?
- Why Python?
- Who Uses Python?
- Characteristics of Python
- Features and Limitations of Python
- Important Libraries of Python

1.3 Working with Python

- Basic Syntax
- Running Python Programs
- Variable and Data Types
- Operators
- Using Numeric Variables
- Using String Variables
- Printing with Parameters
- Getting Input from a User

Unit-2: Making Decisions & Loops   (10 Hours)

2.1 Logical Expressions

- The "if" Statement
- Logical Operators
- More Complex Expressions

2.2 Lists and Tuples

- List Functions
- "For" Loops
- "While" Loops

2.3 Functions

- Dates and Times
- Advanced Data and Time Management
- Random Numbers
- The Math Library
- Writing and Calling Functions
- Function Inputs and Outputs
- Local and Global Scope

2.4 Working with Strings

- Character Data
- What is string?
- String operations and indices
- Basic String Operations
- String Functions, Methods
- Delete a string
- String Multiplication and concatenation
- String Formatting Operator

- ➢ Structuring with indentation in Python
- ➢ Built-in String Methods
- ➢ Accessing Values in Strings
- ➢ Various String Operators
- ➢ Some more examples
- ➢ Python String replace() Method
- ➢ Changing upper and lower case strings
- ➢ Using "join" function for the string
- ➢ Reversing String
- ➢ Split Strings

Unit-3: Python Advanced Concepts   (10 Hours)

3.1   Classes and Objects
- ➢ Thinking about Objects
- ➢ Class Variables and Methods
- ➢ Managing Class Files
- ➢ Creating Objects with Instance Data
- ➢ Instance Methods
- ➢ Managing Objects

3.2 Python Lists
- ➢ Lists are mutable
- ➢ Getting to Lists
- ➢ List indices
- ➢ Traversing a list
- ➢ List operations, slices and methods
- ➢ Map, filter and reduce
- ➢ Deleting elements
- ➢ Lists and strings

3.3 Python Dictionary

- How to create a dictionary?
- PYTHON HASHING?
- Python Dictionary Methods
- Copying dictionary
- Updating Dictionary
- Delete Keys from the dictionary
- Dictionary items() Method
- Sorting the Dictionary
- Python Dictionary in-built Functions
- Dictionary len() Method

3.4 Python Date and Time

- How to Use Date & Date Time Class
- How to Format Time Output
- How to use Time delta Objects
- Calendar in Python
- datetime classes in Python
- How to Format Time Output?
- The Time Module
- Python Calendar Module
- Python Text Calendar, HTML Calendar Class

UNIT-4: File Handling   (10 Hours)
4.1 Introduction to File

- What is a data, Information File?
- File Objects
- File Different Modes and Object Attributes
- How to create a Text Fil and Append Data to a File and Read a File
- Closing a file
- Read, read line ,read lines, write, write lines…!!
- Renaming and Deleting Files

- ➢ Directories in Python
- ➢ Working with CSV files and CSV Module
- ➢ Handling IO Exceptions

4.2 Data Analytics

- ➢ Introduction to data Big Data?
- ➢ Introduction to NumPY and SciPY
- ➢ Introduction to Pandas and MatPlotLib

COURSE-2: **MACHINE LEARNING** (4:1:1) (60 HOURS)

UNIT-1: Foundations for ML   (20 Hours)

1.1   Introduction to Machine Learning

- Machine Learning Architecture
- Definition of learning systems.
- Goals and applications of machine learning
- Aspects of developing a learning system: training data, concept representation, function approximation.
- Machine Learning Methods
- Predictive Models
- Descriptive Models
- Classification Models
- What are the steps used in Machine Learning?
- What is Deep Learning?

1.2   Univariate Numerical Analysis in ML

- Mean, Median, Mode
- Z-scores
- Bias -variance dichotomy
- Sampling and t-tests
- Sample vs Population statistics
- Random Variables
- Probability distribution function
- Expected value
- Binomial Distributions
- Normal Distributions
- Central limit Theorem
- Hypothesis testing
- Z-Stats vs T-stats
- Type 1 type 2 error

UNIT-2: Classification Task   (20 Hours)

2.1   The concept learning task.

- ➢ Concept learning as search through a hypothesis space.
- ➢ General-to specific ordering of hypotheses.
- ➢ Finding maximally specific hypotheses.
- ➢ Version spaces and the candidate elimination algorithm. Learning conjunctive concepts.
- ➢ The importance of inductive bias.

2.2   Bayesian Learning

- ➢ Probability theory and Bayes rule.
- ➢ Naive Bayes learning algorithm.
- ➢ Parameter smoothing.
- ➢ Generative vs. discriminative training.

2.2   Artificial Neural Networks

- ➢ Neurons and biological motivation.
- ➢ Linear threshold units.
- ➢ Perceptron: representational limitation and gradient descent training.
- ➢ Multilayer networks and backpropagation.
- ➢ Hidden layers and constructing intermediate, distributed representations

UNIT-3: Predictive Task   (20 Hours)

3.1 Regression

- Different types of Regression-
- Linear Regression
- Logistic Regression
- Decision tree Algorithms
- Representing concepts as decision trees.
- Recursive induction of decision trees.
- Picking the best splitting attribute: entropy and information gain.
- Searching for simple trees and computational complexity.
- Overfitting, noisy data, and pruning

3.2 Instance-Based Learning

- Constructing explicit generalizations versus comparing to past specific examples.
- k-Nearest- neighbor algorithm.
- Case- based learning.

3.3 Unsupervised Learning

- Learning from unclassified data.
- Clustering.
- Hierarchical Agglomerative Clustering.
- k-means partitional clustering.
- Expectation maximization (EM) for soft clustering.
- Semi-supervised learning with EM using labeled and unlabeled data.

Unit-5: Deep Learning   (20 Hours)

5.1   Introduction to Deep Learning Getting Started with TensorFlow 2.0

- ➢ Convolutional Neural Network
- ➢ Emotion and Gender Detection
- ➢ YOLO Object Detection
- ➢ Image segmentation
- ➢ Voice Detection from speech signal

5.2 Deep Learning applications:

- ➢ Image Processing
- ➢ Natural Language Processing
- ➢ Speech Recognition
- ➢ Video Analytics

Textbooks:

1. Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)   by Oliver Theobald
2. Fundamentals of Machine Learning for Predictive Data Analytics: Algorithms, Worked Examples, and Case Studies (1st Edition) by John D. Kelleher, Brian Mac Namee, and Aoife D'Arcy
3. Machine Learning (in Python a nd R) For Dummies (1st Edition) by John Paul Mueller and Luca Massaron.
4. Head First Python by Paul Barry
5. Learning Python, 5th Edition by Mark Lutz
6. Python for Data Analysis, 2e: Data Wrangling with Pandas, NumPy, and Ipython by Wes McKinney
7. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

References:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.

4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

CAPSTONE PROJECTS

1. Classification
    - Medical Domain
    - Business Domain

2. Clustering
    - Education Domain
    - Social Media

3. Prediction
    - Natural Disasters
    - Stock Market

4. Detection
    - Disorder / Disease
    - Credit card Fraud

CASE STUDY

Based on the following Machine Learning Tasks
Detection
Classification
Prediction

Question Paper pattern

Duration: 02 Hours
Maximum Marks: 50

The final examination, component C5 is to be conducted for 50 marks, which includes objective for 10 marks and descriptive type of questions for 40 marks. The question paper will have two sections Part-A and Part-B.
Part-A is compulsory, comprising objective type, each question carries 1 mark. In Part-B choice will be provided for the student to select any 4 complete question and write descriptive answer, each question carries 10 marks.