M.Sc. DATA SCIENCE
(2025 – 2027)

(For candidates admitted in the academic year 2025-26)
HOLY CROSS COLLEGE (AUTONOMOUS) Tiruchirappalli - 620002.
Affiliated to Bharathidasan University
Nationally Accredited (4th Cycle) with 'A++' Grade (CGPA 3.75/4) by NAAC
College with Potential for Excellence
PG DEPARTMENT OF DATA SCIENCE
Programme: M. Sc. Data Science

PO. No	Programme Outcomes *Upon completion of the M.Sc. Data Science Degree Programme, the graduate will be able to*
PO-1	**Disciplinary Knowledge:** Exhibit a profound masteryof theories, methodologies, and tools in the Data Science field.
PO-2	**Research Related skills:** Utilize independent research to create findings and solutions to address the real-time problems.
PO-3	**Problem Solving:** Apply employability skills to confidently navigate in the job market and excel in Visualizing Tools in diverse professional settings.
PO-4	**Moral and ethical awareness:** Demonstrate a strong commitment to ethical and moral values, actively engage in activities that promote Emerging Technologies in Data Science.
PO-5	**Lifelong Learning and Communication Skills:** Embrace a commitment to professional development, possessing the Technical Skills to adapt to the evolving trends, engage in self- directed learning and continuously enhance their expertise.
PO-6	**Critical Thinking:** Apply the mathematical techniques, software development strategies, tools and organize information system and services to draw solution to complex and multidisciplinary scenario.
PO-7	**Self-directedLearning:** Design solutions for Web Technologies with digitalized environmental considerations.
PO-8	**Scientific Reasoning:** Enhance AI models for predictive analytics to forecast trends, identify patterns, and anticipate future outcomes, enabling proactive decision-making and risk mitigation strategies.
PO-9	**Reflective Thinking:** Employ learning to personalize innovative experiences in concept such as Machine learning and Deep learning.

PSO. No	Programme Specific Outcomes *Upon completion of these courses the learners would have the*
PSO-1	Develop computer programs in the fields related to Artificial Intelligence, Advanced Data Science techniques for efficient design of computer- based systems of varying complexity.
PSO-2	Implement ethical sustainable solutions in the areas of Data Science using programming languages, database systems, machine learning and big data analytics tools.
PSO-3	Apply the Knowledge in the field of data science and experience an environment conducive in cultivating skills for successful career, entrepreneurship and higher studies in Robotics.

(For candidates admitted in the academic year 2025-26)
HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI
SCHOOL OF MATHEMATICAL COMPUTATION SCIENCES
PG DEPARTMENT OF DATA SCIENCE
CHOICE BASED CREDIT SYSTEM
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (LOCF)
PG COURSE PATTERN
Programme: M. Sc. Data Science

Semester	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
I	Core Course 1	Fundamentals of Data Science	P25DS1CCT01	5	3	100
	Core Course 2	Statistics For Data Science	P25DS1CCT02	6	4	100
	Core Course 3	Python Programming	P25DS1CCT03	5	3	100
	Core Course 4	Python Programming – Lab	P25DS1CCP04	5	4	100
	Elective Course 1 (Discipline Specific)	Data Science Using R / Internet of Things	P25DS1ECT01/ P25DS1ECT02	4	3	100
	Elective Course 2 (Discipline Specific)	Data Science Using R – Lab / Internet of Things – Lab	P25DS1ECP03/ P25DS1ECP04	4	3	100
		Value Education		1		
		Total		**30**	**20**	**600**

Semester	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
II	Core Course 5	Foundations of Machine Learning	P25DS2CCT05	5	4	100
	Core Course 6	Machine Learning –Lab	P25DS2CCP06	4	3	100
	Core Course 7	Database Technology	P25DS2CCT07	4	3	100
	Core Course 8	Database Technology – Lab	P25DS2CCP08	4	4	100
	Elective Course 3 (Discipline Specific)	Exploratory Data Analysis/ Social Media Analytics	P25DS2ECT05/ P25DS2ECT06	4	3	100
	Elective Course 4 (Generic)	Statistical Inference/ Information Sources in Science and Technology/ Cyber Security	P25MA2ECT07/ P23LS2ECT07/ P24CA2ECT07	4	3	100
	SEC I	Non-Major Elective I		4	2	100
		Massive Open Online Course (MOOC)	P25EXCONC01		2(EC)	
		Internship (30 hours)	P25EX2INT01		2(EC)	100
		Value Education		1		
	Total			**30**	**22+4**	**700+100**

Semester	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
III	Core Course 9	Deep Learning	P25DS3CCT09	5	5	100
	Core Course 10	Deep Learning – lab	P25DS3CCP10	5	4	100
	Core Course 11	Full Stack Development	P25DS3CCT11	5	4	100
	Core Course 12	Full Stack Development - Lab	P25DS3CCP12	5	4	100
	Core Course 13	Industrial Module - Business Analytics	P25DS3CCT13	4	4	100
	Elective Course 5 (Generic)	Block chain Technology/ Statistical Packages/ Ethics and Evaluation in Research	P25CA3ECT08/ P24MA3ECT08/ P23LS3ECT08	3	3	100
		Internship (30 hours)	P25DS3INT01	-	2	100
	SEC 2	Non-Major Elective 2		3	2	100
		Total		**30**	**28**	**800**

Semester	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
IV	Core Course 14	Advanced Web Technology with Django	P25DS4CCT14	4	4	100
	Core Course 15	Data Visualization Tools – Lab	P25DS4CCP15	4	3	100
	Core Course 16	Advanced Web Technology with Django – Lab	P25DS4CCP16	4	3	100
		Project with Viva Voce	P25DS4DIS01	10	7	100
	Elective Course 6 (Discipline Specific)	Advanced Computing Technologies/ Data Engineering	P25DS4ECT09 / P25DS4ECT10	4	3	100
	SEC 3	Professional Competency Skill Enhancement Course – Federated Learning	P25DS4SET03	4	2	100
	Extension Activity	Extension Activity: Centre for Rural Development and Extension (CRDE & RESCAPES)	P24EX4RES01		2(EC)	100
	Self-Study Course	Professional Ethics	P24DS4SST01		2(EC)	100
		Total		**30**	**22+4**	**400+200**
		Grand Total		**120**	**92+8**	**2400+400**

ELECTIVE COURSES OFFERED BY THE DEPARTMENT

Semester	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
II	Elective Course 4 (Generic)	Python for Data Analytics/ Artificial Intelligence and Machine learning - Lab	P25DS2ECT07 / P25DS2ECP08	4	3	100
III	Elective Course 5 (Generic)	Fundamentals of Big Data Analytics	P25DS3ECT09	3	3	100

NME COURSES OFFERED BY THE DEPARTMENT FOR PG

Semester	Course	Title of the Course	Code	Hrs/Hk	Credits	Marks
II	Non-Major Elective 1	Visual Analytics for Business Intelligence - Lab	P25DS2SEP01	4	2	100
III	Non-Major Elective 2	Generative AI –Lab	P25DS3SEP02	3	2	100

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 1: FUNDAMENTALS OF DATA SCIENCE**
Course Code	**P25DS1CCT01**
Course Type	**Theory**
Semester	**I**
Hours / Week	**5**
Total Hours	**75**
Credits	**3**
Marks	**100**

CONSPECTUS

To introduce the concepts and fundamentals of data science and its life cycle.

COURSE OBJECTIVES

1. To understand the types of data and analytics, data science process, and its life cycle.
2. To apply math in data science.
3. To analyze the various data intensive operations and tools.
4. To evaluate the tools and methods for analyzing the data.
5. To investigate the recent potential applications and development of data science with real time case studies

UNIT I – Introduction of Data Science **(15 Hrs)**

1.1 Data Science – Data science Venn diagram – Basic terminology – Data science case studies.
1.2 Types of data – Levels of data.
1.3 Types of data analytics – Descriptive, Diagnostic, Predictive, and Prescriptive analytic.
1.4 Five steps of Data science.

Extra Reading / Keywords: *Skills needed in doing data science*

UNIT II – Mathematical Preliminaries **(15 Hrs)**

1.1 Basic Maths – Mathematics as discipline – Basic symbols and terminology Linear algebra.
1.2 Basic Probability – Definitions – Bayesian vs. frequentist approaches.
1.3 Compound events – Conditional probability – Rules of probability.
1.4 Applications of math in data science.

Extra Reading /Keywords: *Vectors, Data models and data frames*

UNIT III – DATA MINING AND DATA WAREHOUSING **(15 Hrs)**

1.1 Introduction to Data warehousing – Design considerations of data warehouse.
1.2 Data loading process – Case study.
1.3 Data mining – Data mining techniques – Tools and platforms.
1.4 Supervised and unsupervised learning – Case study.

Extra Reading /Keywords: *Supervised learning, unsupervised learning*

UNIT IV – Visualizing Data **(15 Hrs)**

1.1 Exploratory Data Analysis (EDA).
1.2 Developing the visual aesthetic – Chart types – Great visualizations.
1.3 Reading graphs – Interactive visualizations.
1.4 Visualization tools and libraries (Matplotlib, Seaborn, D3.js, Bokeh, ggplot).
Extra Reading /Keywords: *MongoDB, Redis, Couch DB, Riak, Neo4j, HBASE*

UNIT V – Data Science – Recent Trends **(15 Hrs)**

5.1 Applications of Data Science in various domains.
5.2 Recent trends in data collection and analysis techniques.
5.3 Visualization techniques and application development methods.
5.4 Real-time data science case studies.
Extra Reading /Keywords: *visualization libraries (matplotlib, seaborn, D3.js, bokeh, gplot)*

Note: Texts given in the Extra Reading /Key Word must be tested only through Assignment and seminars.

PRESCRIBED TEXT BOOKS

1. Ozdemir, Sinan. Principles of Data Science. Packt Publishing Ltd, 2016.
   UNIT I: Chapter 1, 2, 3
   UNIT II: Chapter 4,5).
2. Maheshwari, Anil. "Data analytics made Accessible." Seattle: Amazon Digital Services, 2nd edition, 2023
   Unit III: Chapter 3 and 4
3. Skiena, Steven S. The data science design manual. Springer, 2017.
   UNIT IV: Chapter 6

SUGGESTED READINGS

1. HadrienJean.Education, C. (2023). Data Science. Certybox Education. Pierson, Lillian. Data science for dummies.
2. John Wiley & Sons, 2021.Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media, 2019
3. Blum, Avrim, John Hopcroft, and Ravindran Kannan. Foundations of data science. Cambridge University Press, 2020

WEB REFERENCES

1. https://www.simplilearn.com/data-science-trends-article
2. https://www.analyticsvidhya.com/
3. https://www.simplilearn.com
4. https://www.ibm.com/in-en/topics/data-science
5. https://www.mygreatlearning.com/blog/what-is-data-science/

Note: Learners are advised to use latest edition of book

COURSE OUTCOMES
The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	describe the fundamentals of data science	K1
CO 2	discuss data analysis techniques for various applications	K2
CO 3	explain the various algorithms used in data science and develop skill related to algorithmic concepts	K3
CO 4	illustrate various database systems with nosql	K4
CO 5	discuss acid principles and base principles and data visualization	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING
PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	H	L	H	L	M	H
CO 2	H	H	H	L	M	H	M	L	M
CO 3	H	M	M	H	H	M	H	M	L
CO 4	L	M	L	M	M	H	L	M	H
CO 5	M	M	H	H	M	M	H	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	H	M
CO 2	M	H	H
CO 3	L	H	M
CO 4	M	L	H
CO 5	H	M	L

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 2: STATISTICS FOR DATA SCIENCE**
Course Code	**P25DS1CCT02**
Course Type	**Theory**
Semester	**I**
Hours / Week	**6**
Total Hours	**90**
Credits	**4**
Marks	**100**

CONSPECTUS

To develop knowledge about fundamental concepts in probability and statistics. To analyze the characteristics of data by using relevant statistical tools

COURSE OBJECTIVES

1. To understand various methods of collection of data and representing them through graphs.
2. To describe various measures of dispersion and correlation
3. To discuss various types of distribution functions, calculate and interpret expected results
4. To apply the methods of estimating a parameter
5. To evaluate probability, conditional probability and its axiom and theorems.

UNIT I – Collection and Presentation of Data (18 Hrs)

1.1 Origin and development of statistics – scope – limitations – misuse of statistics.

1.2 Types of data and measurements – methods of data collection – primary and secondary data.

1.3 Presentation of data by tables and graphs – construction of frequency distributions – histogram and frequency polygon – cumulative frequency curve.

1.4 Application of data collection in data science.

Use Case: Applications of Healthcare Data Analysis Sectors.

Extra Reading / Key Words: ***Business statistics, Functions and distrust of statistics.***

UNIT II – Measures of Central Tendency (18 Hrs)

2.1 Mean – Median – Mode – computation for discrete and continuous series.

2.2 Measures of dispersion – range – mean deviation – quartile deviation – standard deviation. Correlation – scatter diagram – Karl Pearson's coefficient – rank correlation.

2.3 Application of correlation in data science.

2.4 **Use Case:** Correlation in Business Monitoring.

Extra Reading / Key Words: Grouped data, Gaussian distribution, Laplace distribution.

UNIT III – Random Variables, Expectation and Special Distributions (18 Hrs)

3.1 Distribution functions – discrete and continuous random variables – two-dimensional random variables.

3.2 Expectation – properties – variance – covariance.

3.3 Special distributions – Gamma, Chi-Square, t, and F distributions.

3.4 Application of Chi-Square test in machine learning.

Use Case: Chi-Square Test in Online Shopping Preferences.

Extra Reading / Key Words: *Multinomial distribution, compound marginal distribution, probability distribution fitting.*

UNIT IV – Estimation **(18 Hrs)**

4.1 Characteristics of estimators – unbiasedness, consistency, efficiency.

4.2 Cramer-Rao inequality – methods of estimation – method of moments – maximum likelihood.

4.3 Confidence interval and confidence limits.

4.4 Applications of estimation in data science.

Use Case: Estimation in Environmental Science.

Extra Reading / Key Words: *Multivariate Cramer-Rao bound, log-normal distribution, mean- squared-error version.*

UNIT V – Basics and Elements of Probability **(18 Hrs)**

5.1 Classical definition – addition and multiplication theorems odds in favour and against events.

5.2 Axiomatic approach – axioms of probability – conditional probability – Baye's theorem.

5.3 Independent events – multiplicative law of probability.

5.4 Applications of probability in machine learning.

Use Case: Data Cleaning in Data Science Using Probabilities.

Extra Reading / Key Words: *Stock market, Tree diagram, Mutually exclusive events.*

Note: Texts given in the Extra Reading /Key Word must be tested only through Assignment and seminars.

PRESCRIBED TEXT BOOKS

1. Treatment and content as in Pillai R.S. N, Bagavathi. V, Statistics, S.Chand and Company, New Delhi, 2007
   UNIT I: Chapter 1,4,6,7 & 8
   UNIT II: Chapter 9, 10 &12
2. Gupta S.C and Kapoor V.K, Fundamentals of Mathematical Statistics, 11th edition, Sultan Chand & Sons, New Delhi, 2014.
   UNIT III: Chapter 5 (5.1-5.5), **C**hapter 6(6.1-6.6), Chapter 15(15.1-15.3)
   UNIT IV: Chapter 17 (17.1-17.3, 17.6)
3. Vittal. P.R, Mathematical Statistics, Margham Publishers, Chennai, 2002.
   UNIT V: Chapter 1

SUGGESTED READINGS

1. Arora. S, Sumeet Arora, Comprehensive Statistical Methods, S. Chand and Company Ltd, New Delhi, 2002.
2. Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries.
3. Gupta. S.P, Statistical Methods, Sultan Chand & Sons, New Delhi 2006.Rohatgi V.K and Saleh E, An Introduction to Probability and Statistics, 3rd edition, John Wiley & Sons Inc., New Jersey, 2015.
4. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Elsevier Academic Press, UK, Fifth Edition, 2023.

WEB REFERENCES

1. https://www.simplilearn.com/tutorials/statistics-tutorial/what-is-correlation-in-statistics.
2. https://www.geeksforgeeks.org/ml-chi-square-test-for-feature-selection/?ref=ml_lbp.
3. https://www.analyticsvidhya.com/blog/2021/03/quick-guide-to-estimation/.
4. https://www.datasciencecentral.com/understanding-the-applications-of-probability-in-

Note: Learners are advised to use latest edition of books

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	define basic statistical concepts, measures of dispersion, correlation, random variable, estimation and probability	K1
CO 2	identify the method of collecting primary and secondary data.	K2
CO 3	apply the concept of measures of central tendency, coefficient of correlation, estimation and probability.	K3
CO 4	analyse the concepts of statistics and probability in real life problems	K4
CO 5	evaluate various types of distribution and describe their properties	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO–CO MAPPING

CO/PO	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9
CO 1	H	L	L	L	L	H	L	L	L
CO 2	L	H	L	L	M	M	M	M	H
CO 3	M	L	H	M	L	H	L	L	M
CO 4	H	M	M	L	M	H	H	H	L
CO 5	M	L	L	M	L	H	L	H	M

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	L
CO 2	M	H	M
CO 3	H	M	L
CO 4	H	H	M
CO 5	H	M	M

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 3: PYTHON PROGRAMMING**
Code	**P25DS1CCT03**
Course Type	**Theory**
Semester	**I**
Hours/Week	**5**
Total Hours	**75**
Credits	**3**
Marks	**100**

CONSPECTUS

To be able to think logically and develop interactive programs using the python constructs, functions, data structures, classes and objects, files.

COURSE OBJECTIVES

1. To learn and apply core Python scripting elements, including variables and flow control structures.
2. To understand and utilize Python functions to promote code reuse.
3. To explore and implement Python's object-oriented programming features.
4. To familiarize students with advanced string handling, special methods, and efficient use of Python data structures.
5. To introduce students to efficient data analysis using NumPy and Pandas for array operations and structured data manipulation.

UNIT I – Introduction to Computers, Programs and Python (15 Hrs)

1.1 Computers and Programming Concepts – Components, Operating Systems, and Programming Languages
1.2 Introduction to Python – Installation, IDEs, Style Guidelines, and Documentation
1.3 Elementary Programming – Input/Output, Identifiers, Variables, Expressions, and Operators
1.4 Mathematical Functions, Strings, and Objects – Common Python Functions, String Formatting, and Graphics Programming

Extra Reading / Keywords: *Formatting Output, Random and Statistical Modules, Regular Expressions, Drawing with Turtle*

UNIT II – Selections and Loops (15 Hrs)

2.1 Boolean Expressions and Random Number Generation
2.2 Conditional Control – if, if-else, Nested if, and Conditional Expressions
2.3 Loops – while, for, Nested Loops, Break and Continue Statements
2.4 Control Flow and Logical Operators in Iterative Tasks

Extra Reading / Keywords: *Iterables, Iterators, List Comprehension, Generator Expressions*

UNIT III – Functions, Objects, and Classes (15 Hrs)

3.1 Functions – Defining, Calling, and Returning Values
3.2 Function Parameters – Positional, Keyword, and Default Arguments
3.3 Object-Oriented Concepts – Classes, Objects, Encapsulation, and UML Class Diagrams
3.4 Inheritance and Polymorphism – Subclasses, Overriding, and Dynamic Binding

Extra Reading / Keywords: *Constructors, Instance Variables, Method Overriding, Class Abstraction*

UNIT IV – Strings, Lists, Tuples, Sets, and Dictionaries (15 Hrs)

4.1 String Class and Operator Overloading
4.2 Lists – Basics, Copying, Passing to Functions, Sorting, and Searching
4.3 Multidimensional Lists – Creation, Traversal, and Manipulation
4.4 Tuples, Sets, and Dictionaries – Operations, Performance Comparison, and Applications
Extra Reading / Keywords: *Indexing and Slicing, Tuple Packing and Unpacking, Frozen Sets, Dictionary Views*

UNIT V – Introduction to Numpy and Pandas (15 Hrs)

5.1 NumPy – Array Basics, Computations, and Aggregations
5.2 Advanced NumPy – Broadcasting, Boolean Logic, Sorting, and Structured Arrays
5.3 Pandas – DataFrames, Series, Indexing, and Selection
5.4 Data Manipulation – Handling Missing Data, Combining Datasets, and Working with Time Series
Extra Reading / Keywords: Universal Functions, Broadcasting, Random Sampling, Reshaping, Pivot Tables

Note: Texts given in the Extra Reading / Keywords must be tested only through assignments and seminars.

PRESCRIBED TEXT BOOKS

1. Y. Daniel Lang, "**Introduction to Programming using Python**", 2nd Edition, Pearson, Education Inc., 2013.
   UNIT I: Chapter 1,2, 3
   UNIT II: Chapter 4,5
   UNIT III: Chapter 6,7,1
   UNIT IV: Chapter 8,10,11
2. Jake Vander Plas, "**Python Data Science Handbook: Essential Tools for Working with Data**", 1st Edition, O'Reilly Media, 2016
   UNIT V: Chapter 2,3

SUGGESTED READINGS

1. Allen B. Downey. Think Python. How to Think Like a Computer Scientist, 2ndedition, O'Reilly Publishers, 2016
2. Corey Wade, et al : *The Python Workshop,* 2nd Edition, Packt, 2022David Beazley, Brian K. Jones.
3. Python Cookbook: Recipes for Mastering Python 3, 3rd Edition, 2013 Harsh Bhasin. Python for Beginners. New Age International Publishers,2018.
4. Martin C. Brown. Python: The Complete Reference. McGraw Hill Education; Fourth edition, 2018.

WEB REFERENCES

1. https://realpython.comhttp://docs.python.org,
2. http://diveintopython.org/,
3. https://www.w3schools.com/python/ ,
4. https://www.tutorialspoint.com/python/index.html

Note: Learners are advised to use latest edition of books

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	identify the components of a computer and demonstrate the appropriate use of data types, mathematical functions, and strings in a program.	K1
CO 2	compare and choose an appropriate selection and looping construct for a given problem.	K2
CO 3	build applications using functions, classes, and objects for a given problem.	K3
CO 4	analyse lists and strings on new problems using appropriate data structures.	K4
CO 5	develop applications using different data structures like tuples, sets, dictionaries, and files	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	L	H	M	M	M
CO 2	H	M	H	M	M	H	M	M	H
CO 3	L	H	L	H	H	H	H	H	H
CO 4	L	H	L	H	H	M	H	H	H
CO 5	L	H	L	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	H	M
CO 4	M	M	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	CORE COURSE 4: PYTHON PROGRAMMING – LAB
Code	P25DS1CCP04
Course Type	Practical
Semester	I
Hours/Week	5
Total Hours	75
Credits	4
Marks	100

CONSPECTUS

To be able to apply appropriately the python programming knowledge gained and develop computer-based solutions for a given problem

COURSE OBJECTIVES

1. To gain proficiency in writing Python programs, conducting thorough testing procedures, and effectively debugging code to ensure functionality and reliability.
2. To apply conditional statements and various loop structures in Python to control program flow and iterate over data structures efficiently.
3. To utilize functions for code modularity and clarity, and effectively manage compound data types like lists, tuples, and dictionaries to organize and manipulate data effectively
4. To learn how to build and package Python modules for reusability.
5. To acquire the skills necessary to develop and package Python modules that enhance code reusability and maintainability across different projects and scenario

EXERCISES

1. Python Basics & Geometry – Input student details and compute area and perimeter of basic shapes.
2. Math Module & Expressions – Solving math expressions and quadratic equations using math functions.
3. Python String Processing – Manipulating and formatting strings using slicing and methods.
4. Conditional Statements in Python – Implement grading logic and a number guessing game using if-elif-else.
5. Python Looping Techniques – Creating patterns and performing calculations using for and while loops.
6. Modularization with Functions – Implementing factorial, palindrome, GCD, and LCM using user-defined functions.
7. Object-Oriented Bank in Python – Creating Python classes and objects for banking and student grading.
8. Python Inheritance & Polymorphism – Building shape classes with overridden methods using OOP concepts.
9. Python List Processing – Sorting, searching, and finding key values from lists.
10. Python Collections Programming – Performing operations with matrices, sets, and dictionaries.
11. NumPy Array Operations – Creating and manipulating arrays using NumPy's array-based features.

12. Pandas Data Handling – Reading CSV and processing data using Pandas library functions.

COURSE OUTCOMES

The Learner will be able to

CO. No	Course Outcomes	Cognitive Level (K1-K5)
CO 1	identify the components of a computer, demonstrate the appropriate use of data types, mathematical functions and strings in a program	K1
CO 2	explain the use of selection and looping constructs, compare and choose an appropriate construct for a given problem.	K2
CO 3	develop modular programming using functions, design program using OO constructs.	K3
CO 4	compare strings and lists, implement lists and strings appropriately, design new problems using appropriate data structures	K4
CO 5	recommend different data structures such as tuples, sets, dictionaries, files for developing applications.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	M	H	H	H	M	H
CO 2	H	H	H	M	M	H	H	H	H
CO 3	H	H	M	M	H	H	H	H	H
CO 4	H	H	H	M	M	M	H	M	H
CO 5	H	H	M	M	H	M	M	H	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	M	M
CO 4	M	H	H
CO 5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	ELECTIVE COURSE 1 (DISCIPLINE SPECIFIC): DATA SCIENCE USING R
Code	P25DS1ECT01
Course Type	Theory
Semester	1
Hours/Week	4
Total Hours	60
Credits	3
Marks	100

CONSPECTUS

The course aims to provide a strong foundation in R programming concepts, data structures, and functions for effective statistical computing. It also focuses on developing skills to analyze, visualize, and interpret data using R for real-world problem solving.

COURSE OBJECTIVES

1. To recall the fundamentals of R programming and explore its advantages
2. To understand data types, variables, and control structures used in R.
3. To analyze data structures like vectors, matrices, data frames, and lists
4. To evaluate datasets using descriptive statistics and exploratory data analysis.
5. To experiment with data visualization techniques and file handling operations in R.

UNIT I - Introduction to R **(12 Hrs)**

1.1 Installation of R, IDEs and Handling Packages
1.2 Working Directory, Basic Commands & Data Exploration
1.3 Data Types in R – Numeric, Character, Logical, Factor
1.4 Importing and Accessing Help in R Environment
Extra Reading / Keywords: *RStudio shortcuts and preferences, R help documentation*

UNIT II - Loading and Handling Data **(12 Hrs)**

2.1 Variables, Expressions & Functions in R
2.2 Handling Missing Values, Data Cleaning Methods
2.3 Data Structures – Vectors, Matrices, Lists
2.4 Using as() for Data Type Conversion
Extra Reading / Keywords: *Data coercion rules in R, Handling missing values: na.omit(), is.na()*

UNIT III - Exploring Data in R **(12 Hrs)**

3.1 Introduction to Data Frames & Data Loading
3.2 Data Exploration – Summary, Outliers, Invalid Values
3.3 Visual Data Inspection using Plots
3.4 Descriptive Statistics using R Functions
Extra Reading / Keywords: *summary(), str(), head() for initial analysis, Histogram and boxplot interpretation, Detecting outliers using Z-score/IQR*

UNIT IV - Linear Regression Using R **(12 Hrs)**

4.1 Model Fitting – Linear Regression in R
4.2 Assumptions & Validation of Linear Regression

4.3 Logistic Regression – Binary Classification
4.4 GLM in R – Diagnostics & Interpretation
Extra Reading / Keywords: *Linearity checks using residual plots, Multicollinearity (VIF), Overfitting, ROC Curve & Confusion Matrix*

UNIT V - Decision Tree in R **(12 Hrs)**

5.1 Decision Tree Concepts & Representation
5.2 Tree Building Algorithms – Splitting Measures
5.3 Hypothesis Space Search & Inductive Bias
5.4 Evaluating & Visualizing Decision Trees in R

Note: Texts given in the Extra Reading/Keywords must be tested only through assignment and seminar.

PRESCRIBED TEXT BOOK

1. Seema Acharya, *Data Analytics Using R*, McGraw Hill Education (India), 2018. ISBN: 978-93-5260-524-8.

UNIT I: Chapter 1,2
UNIT II: Chapter 3
UNIT III: Chapter 4
UNIT IV: Chapter 5,6
UNIT V: Chapter 7

SUGGESTED READINGS

1. "The Art of R Programming" – Norman Matloff, No Starch Press.
2. "R for Data Science" – Hadley Wickham & Garrett Grolemund, O'Reilly.
3. "Hands-On Programming with R" – Garrett Grolemund, O'Reilly.
4. "Practical Data Science with R" – Nina Zumel & John Mount, Manning.

WEB REFERENCES

1. https://www.r-project.org
2. https://cran.r-project.org
3. https://www.rdocumentation.org

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	identify the fundamentals of r programming concepts, data types, and structures	K1
CO 2	recognize the role of r in statistical computing and data analysis applications	K2
CO 3	apply various r libraries and their usage in data handling and visualization	K3
CO 4	analyze the data analysis solutions using r functions and control structures	K4
CO 5	create effective visualizations and models in r to solve real- world data science problems	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	H	L	M	H	M	L	H
CO 2	M	M	H	M	H	M	H	H	M
CO 3	H	M	M	H	H	L	M	M	H
CO 4	H	H	H	M	M	M	H	H	L
CO 5	M	H	L	H	H	H	M	H	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	L
CO 2	H	M	M
CO 3	M	H	M
CO 4	L	M	H
CO 5	M	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 1 (DISCIPLINE SPECIFIC): INTERNET OF THINGS**
Code	**P25DS1ECT02**
Course Type	**Theory**
Semester	**I**
Hours/Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To understand the concepts, data, framework, standards, protocols, reliability, security and privacy involved in IOT

COURSE OBJECTIVES

1. To understand the fundamentals of internet of things
2. To realize the internet of things ecosystem using wireless technologies
3. To analyze various protocols for internet of things
4. To explore the design methodology of m2m communication in internet of things
5. To design a portable internet of things using raspberry pi and Arduino

UNIT I – Introduction to IOT **(12 Hrs)**

1.1 Definition, Characteristics and Physical Design of IoT
1.2 IoT Protocols and Communication Models
1.3 IoT Communication APIs and IoT Enabled Technologies (WSN, Cloud, Big Data, Embedded Systems)
1.4 IoT Levels, Templates and Domain Specific IoTs (Home, City, Health, Industry, etc.)
Extra Reading /Keywords*:* *Body area network, skin area network*

UNIT II - Realization of IOT Ecosystem Using Wireless Technologies **(12 Hrs)**

2.1 Mobile-based IoT Architecture and Technologies
2.2 Mobile Use Cases for IoT Applications
2.3 LPWAN Technologies – Sigfox, Weightless
2.4 LPWAN Technologies – Nwave, Ingenu
Extra Reading /Keywords: *Application Software-Android*

UNIT III - Infrastructure and Service Discovery Protocols for the IOT **(12 Hrs)**

3.1 IoT Layered Architecture and Protocol Architecture
3.2 Infrastructure Protocols for IoT
3.3 Device / Service Discovery Protocols
3.4 Security, Integration Technologies, Sensor & Actuator Networks
Extra Reading /Keywords: *OS-Contiki, Cooja*

UNIT IV - IOT and M2M **(12 Hrs)**

4.1 Introduction to M2M Communication
4.2 Differences between IoT and M2M
4.3 SDN and NFV for IoT
4.4 IoT Design Methodology
Extra Reading /Keywords: *Energy aware, Context aware*

UNIT V - Building IOT with Raspberry Pi and Arduino (12 Hrs)

5.1 IoT Systems and Logical Design using Python
5.2 Raspberry Pi: Hardware, Linux OS & Interfaces
5.3 Programming Raspberry Pi with Python
5.4 Other IoT Platforms: Arduino – Architecture, Devices & Integration
Extra Reading /Keywords: *Simulator - Proteus*

Note: Texts given in the Extra Reading/Keywords must be tested only through assignment and seminar.

PRESCRIBED TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti, **"Internet of Things, A Hands-On Approach"**, Universities Press (INDIA) Private Limited,2015.
   UNIT I: Chapters 1, 2.
   UNIT IV: Chapters 5
   UNIT V: Chapters 6
2. Pethuru Raj and Anupama C. Raman, **"The Internet of Things Enabling Technologies, Platforms, and Use Cases"**, Taylor & Francis, CRC Press,2017.
   UNIT II: Chapter 3
   UNIT III: Chapter 4

SUGGESTED READINGS

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", First Edition, Academic Press,2014.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian(Eds), "Architecting the Internet of Things", Springer,2011.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things-key applications and Protocols",Wiley,2012.
4. Ovidiu Vermesan and Peter Friess, "Internet of Things –From Research Innovation to Market Deployment", RiverPublisher, 2014.

WEB REFERENCES

1. https://thingsee.com/blog/quality-hardware-list-for-your-iot-projects
2. https://tools.ietf.org/html/rfc7452.
3. http://dret.net/lectures/iot-
4. https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set
5. https://www.studocu.com/in/document/kalinga-institute-of-industrial-

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1– K5)
CO 1	recognize the basics of the Internet of Things.	K1
CO 2	identify the application of wireless technologies in various domains.	K2
CO 3	differentiate IoT from Machine-to-Machine(M2M) communication.	K3
CO 4	design and demonstrate IoT applications using Python in Raspberry Pi.	K4
CO 5	create a solution for real-time problems across various domains.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	H	L	M	H	M	L	H
CO 2	M	M	H	M	H	M	H	H	M
CO 3	H	M	M	H	H	L	M	M	H
CO 4	H	H	H	M	M	M	H	H	L
CO 5	M	H	L	H	H	H	M	H	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	L
CO 2	H	M	M
CO 3	M	H	M
CO 4	L	M	H
CO 5	M	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	ELECTIVE COURSE 2 (DISCIPLINE SPECIFIC): DATA SCIENCE USING R-LAB
Code	P25DS1ECP03
Course Type	Practical
Semester	I
Hours/Week	4
Total Hours	60
Credits	3
Marks	100

CONSPECTUS

To learn R programs to meet routine and specialized data manipulation, management and analysis.

COURSE OBJECTIVES

1. To develop skills in basic data analytics.
2. To manipulate and manage data using r's data structures
3. To visualize data with r's plotting capabilities
4. To utilize r functions and control structures for efficient coding.
5. To conduct statistical analysis and interpret results using r.

EXERCISES

1. Basic Data Manipulation.
2. Basic Plotting.
3. Loops and Functions.
4. Basic Statistics.
5. Advanced Data Manipulation.
6. Vector and operations on Vector.
7. Matrix and operations on Matrix.
8. Create factorization in R environment.
9. Data Frame and operations on Data Frame.
10. Write R Program to pre-defined functions in R.

COURSE OUTCOMES

The learners will be able to

CO. No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	list the procedures required for installing the r programming environment.	K1
CO 2	utilize r data types for developing programs.	K2
CO 3	apply appropriate r data structures on raw data.	K3
CO 4	develop programming logic using r packages.	K4
CO 5	analyze the datasets using r programming capabilities.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	L	H	M	M	L	H
CO 2	H	H	M	M	L	H	H	M	M
CO 3	H	M	H	M	M	H	H	M	H
CO 4	M	H	H	L	H	M	M	H	H
CO 5	H	H	M	M	H	M	M	H	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	H	H	M
CO 3	H	H	L
CO 4	L	H	M
CO 5	H	M	H

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 2 (DISCIPLINE SPECIFIC): INTERNET OF THINGS-LAB**
Code	**P25DS1ECP04**
Course Type	**Practical**
Semester	**I**
Hours/Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

The course aims to provide hands-on experience in configuring IoT devices, integrating sensors and communication technologies, and developing real-time IoT applications using platforms like Arduino and Raspberry Pi.

COURSE OBJECTIVES

1. To recall the fundamental concepts of IoT architecture, components, sensors, actuators, and communication protocols.
2. To explain the role of microcontrollers, IoT platforms, and wireless technologies in building IoT systems.
3. To implement IoT applications using Arduino/Raspberry Pi with sensor data acquisition and device control.
4. To analyze real-time data transmission, storage, and visualization through IoT cloud platforms and dashboards.
5. To evaluate IoT solutions by testing performance, scalability, and applicability in real-world domains.

EXERCISES

1. **Getting Started with Arduino/Raspberry Pi** – Setting up the development environment, installing IDE, and running a simple "Blink LED" program.
2. **Sensor Interfacing** – Reading data from temperature and humidity sensors (e.g., DHT11/DHT22) and displaying it.
3. **Actuator Control** – Interfacing a servo motor or DC motor with Arduino/Raspberry Pi and controlling it through code.
4. **Wireless Communication** – Establishing communication between IoT devices using Bluetooth or Wi-Fi modules (e.g., ESP8266/ESP32).
5. **Data Transmission to Cloud** – Sending sensor data to IoT cloud platforms (e.g., ThingSpeak, Blynk, or AWS IoT).
6. **Data Visualization** – Creating real-time dashboards to monitor sensor readings (temperature, humidity, light, etc.).
7. **Home Automation System** – Controlling home appliances (light/fan) through IoT using a mobile app or web interface.
8. **Environmental Monitoring** – Building an IoT-based weather station to measure parameters such as temperature, humidity, and air quality.
9. **Security Application** – Implementing an IoT-based intrusion detection/alarm system using PIR motion sensors.
10. **Smart Healthcare Application** – Designing a simple IoT system for patient monitoring

(e.g., heart rate or body temperature sensor).

COURSE OUTCOMES
The learners will be able to

CO. No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	List the steps required for the installation and configuration of Arduino/Raspberry pi development environment	K1
CO 2	utilize IoT components such as sensors and actuators for developing applications.	K2
CO 3	make use of wireless communication protocols (Bluetooth, wi-fi, mqtt) in IoT systems.	K3
CO 4	analyze real-time sensor data using iot cloud platforms and dashboards	K4
CO 5	develop programming logic for iot devices using python/Arduino IDE.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING
PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	L	H	M	M	L	H
CO 2	H	H	M	M	L	H	H	M	M
CO 3	H	M	H	M	M	H	H	M	H
CO 4	M	H	H	L	H	M	M	H	H
CO 5	H	H	M	M	H	M	M	H	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	H	H	M
CO 3	H	H	L
CO 4	L	H	M
CO 5	H	M	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 5: FOUNDATIONS OF MACHINE LEARNING**
Course Code	**P25DS2CCT05**
Course Type	**Theory**
Semester	**II**
Hours / Week	**5**
Total Hours	**75**
Credits	**4**
Marks	**100**

CONSPECTUS

To enable the students to understand the different types, steps and algorithms involved in Machine Learning Process emphasizing their roles and interconnections in building effective ML models.

COURSE OBJECTIVES

1. To recall key mathematical concepts, including linear algebra and probability, along with foundational principles of machine learning.
2. To explain the theoretical foundations and methodologies of supervised learning, unsupervised learning, neural networks, and experimental design techniques.
3. To implement supervised algorithms, ensemble techniques and clustering methods in practical scenarios.
4. To analyze model architectures, optimization challenges and techniques such as hyperparameter tuning, regularization, and batch normalization.
5. To evaluate machine learning models and experiments using cross-validation, performance metrics, and statistical tests to assess algorithm effectiveness.

UNIT I – Introduction to Machine Learning **(15 Hrs)**

1.1 Review of Linear Algebra for Machine Learning – Vectors, Matrices, and Operations.
1.2 Introduction and motivation for Machine Learning – Examples of ML applications.
1.3 Vapnik-Chervonenkis (VC) Dimension and Probably Approximately Correct (PAC) Learning.
1.4 Hypothesis spaces, Inductive bias, Generalization, Bias-Variance trade-off.

Extra Reading / Keywords: *Linear Algebra for ML, VC Dimension, PAC Learning, Hypothesis Spaces.*

UNIT II – Supervised Learning **(15 Hrs)**

2.1 Linear Regression Models – Least squares, single & multiple variables, Bayesian linear regression, gradient descent.
2.2 Linear Classification Models – Discriminant function, Perceptron algorithm, Probabilistic discriminative model – Logistic regression.
2.3 Probabilistic generative model – Naive Bayes; Maximum margin classifier – Support Vector Machine.
2.4 Decision Tree, Random Forests – Structure, training, and interpretation.

Extra Reading / Keywords: *Regression Algorithm, SVM, Decision Trees, Random Forests.*

UNIT III – Ensemble Techniques and Unsupervised Learning (15 Hrs)

3.1 Combining multiple learners – Model combination schemes and Voting.
3.2 Ensemble Learning – Bagging, Boosting, and Stacking techniques.
3.3 Unsupervised Learning – Clustering with K-Means and Hierarchical Methods.
3.4 Instance-based Learning – K-Nearest Neighbors (KNN), Gaussian Mixture Models.
Extra Reading / Keywords: *Model Combination, Bagging, Boosting, K-means.*

UNIT IV – Neural Networks (15 Hrs)

4.1 Multilayer Perceptron – Architecture, Activation Functions, and Feedforward Networks.
4.2 Network Training – Gradient Descent Optimization, Stochastic Gradient Descent, and Error Backpropagation.
4.3 From Shallow to Deep Networks – Vanishing Gradient Problem, ReLU, and Regularization.
4.4 Hyperparameter Tuning, Batch Normalization, and Dropout Techniques for Model Optimization
Extra Reading / Keywords: *Activation Functions, Gradient Descent Optimization, Error Backpropagation, Vanishing Gradient Problem.*

UNIT V – Design and Analysis of Machine Learning Experiment (15 Hrs)

5.1 Guidelines for Machine Learning Experiments – Dataset Preparation and Partitioning.
5.2 Cross-Validation (CV) and Resampling Methods – K-Fold CV, Bootstrapping.
5.3 Measuring Classifier Performance – Accuracy, Precision, Recall, F1 Score, ROC Curves.
5.4 Comparing Classification Algorithms – t-Test, McNemar's Test, and K-Fold CV Paired t-Test.
Extra Reading / Keywords: *Guidelines for Experiments, Cross-Validation, Classifier Performance Metrics, T-Test, McNemar's Test.*

Note: Texts given in the Extra Reading / Keywords must be tested only through Assignment and Seminar.

PRESCRIBED TEXT BOOKS

1. Ozdemir, Sinan. Principles of Data Science. Packt Publishing Ltd, 2016.
UNIT 1: Chapter 1,2,3
UNIT II: Chapter 4,5
2. Maheshwari, Anil. "Data analytics made Accessible." Seattle: Amazon Digital Services, 2nd edition, 2023
UNIT III: Chapter 3 and 4
3. Skiena, Steven S. The data science design manual. Springer, 2017.
UNIT IV: Chapter 6

SUGGESTED READINGS

1. HadrienJean.Education, C. (2023). Data Science. Certybox Education.
2. Pierson, Lillian. Data science for dummies. John Wiley & Sons, 2021.
3. Grus, Joel. Data science from scratch: first principles with python. O'Reilly Media,2019.
4. Blum, Avrim, John Hopcroft, and Ravindran Kannan. Foundations of data science. Cambridge University Press, 2020

WEB REFERENCES

1. https://www.simplilearn.com/data-science-trends-article
2. https://www.analyticsvidhya.com/
3. https://www.simplilearn.com
4. https://www.ibm.com/in-en/topics/data-science
5. https://www.mygreatlearning.com/blog/what-is-data-science/

COURSE OUTCOMES

The learner will be able to

CO. No.	Course Outcomes	Cognitive Level (K1– K5)
CO 1	recognize he fundamental concepts of linear algebra, probability, and machine learning principles, including hypothesis spaces, VC dimension, and PAC Learning.	K1
CO 2	explain the techniques and algorithms used in supervised and unsupervised learning, such as regression, classification, clustering, and ensemble methods.	K2
CO 3	implement neural networks and optimization strategies, such as backpropagation, stochastic gradient descent, regularization, and dropout, for real-world applications.	K3
CO 4	analyze the performance of machine learning models by exploring hyperparameter tuning.	K4
CO 5	evaluate and compare machine learning algorithms and models using cross-validation, performance metrics, and statistical methods.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	H	L	H	L	M	H
CO 2	H	H	H	L	M	H	M	L	M
CO 3	H	M	M	H	H	M	H	M	L
CO 4	L	M	L	M	M	H	L	M	H
CO 5	M	M	H	H	M	M	H	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	H	M
CO 2	M	H	H
CO 3	L	H	M
CO 4	M	L	H
CO 5	H	M	L

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 6: MACHINE LEARNING – LAB**
Course Code	**P25DS2CCP06**
Course Type	**Practical**
Semester	**II**
Hours / Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To enable the students to apply machine learning techniques such as regression, classification, clustering, dimensionality reduction, ensemble methods, neural networks, and NLP through hands-on projects with real-world datasets.

COURSE OBJECTIVES

1. To recall key mathematical concepts (linear algebra, probability) and foundational principles of machine learning.
2. To explain the theoretical foundations and methodologies of supervised learning, unsupervised learning, neural networks, and experimental design techniques.
3. To implement supervised algorithms, ensemble techniques and clustering methods in practical scenarios.
4. To analyze model architectures, optimization challenges and techniques such as hyperparameter tuning, regularization, and batch normalization.
5. To evaluate machine learning models and experiments using cross-validation, performance metrics, and statistical tests to assess algorithm effectiveness.

EXERCISES

Using Iris Dataset:

1. Perform the following linear algebra operations on the Iris dataset's feature matrix.
2. Implement a linear regression model to predict the petal width of Iris flowers using petal length as the independent variable. Evaluate the model using R^2 and Mean Squared Error.
3. Train a logistic regression model to classify Iris flowers as Iris-setosa or not (Iris-versicolor/Iris-virginica). Use sepal length and sepal width as features. Report the model's accuracy.
4. Implement Gaussian Naive Bayes algorithm to predict the species of Iris flowers (Iris-setosa, Iris-versicolor, and Iris-virginica). Compare their accuracy and confusion matrices.
5. Train a Decision Tree and Random Forest classifier to classify the species of Iris flowers. Compare their performance in terms of accuracy and visualization of the decision tree structure.

Using Titanic Dataset:

6. Implement Gradient Boosting classifiers for predicting Titanic passenger survival. Report metrics such as accuracy and F1-score.
7. Combine Logistic Regression, Decision Tree using hard voting and stacking methods. Evaluate the ensemble model's accuracy in predicting Titanic passenger survival.

8. Train a neural network on the Titanic dataset to classify passengers as survivors or non-survivors. Experiment with different optimizers (e.g., SGD, Adam) and learning rates to achieve the best accuracy.
9. Evaluate a Titanic dataset using k-fold cross-validation and bootstrapping. Compare the stability and performance of the model across different folds.
10. Perform Exploratory Data Analysis (EDA) on the Titanic Dataset to uncover insights into passenger survival.

Using Wine Quality Dataset:

11. Apply PCA on the Wine Qualitydataset to reduce the dimensionality of the chemical feature space.
12. Perform K-Means clustering on the Wine Quality dataset using chemical features.
13. Train an SVM classifier on the Wine Quality dataset to classify wines as high quality (score > 6) or low quality (score ≤ 6).
14. Use the Wine Quality dataset's production volume data (if available, or create synthetic time-series data) to forecast future wine production.
15. Apply Natural Language Processing (NLP) techniques to analyze wine reviews and predict wine quality.

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO 1	identify the fundamental concepts and operations of linear algebra and machine learning algorithms.	K1
CO 2	explain the principles and techniques behind linear regression, logistic regression, and naive bayes classifiers.	K2
CO 3	implement machine learning algorithms such as decision trees, random forests, and ensemble methods like bagging and boosting.	K3
CO 4	analyze model performance and assess feature importance using random forests and other evaluation techniques.	K4
CO 5	evaluate and optimize machine learning models using methods like cross-validation, bootstrapping, and performance metrics.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	L	H	M	H	H	M	M	M
CO 2	H	M	H	H	M	M	M	H	H
CO 3	H	H	M	H	L	M	L	M	H
CO 4	M	M	H	H	M	H	M	H	H
CO 5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	M	H	M
CO 3	L	M	H
CO 4	M	L	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 7: DATABASE TECHNOLOGY**
Course Code	**P25DS2CCT07**
Course Type	**Theory**
Semester	**II**
Hours / Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To provide students with the skills to design, implement, and manage databases, and to effectively utilize them for data storage, querying, and analysis in data science workflows.

COURSE OBJECTIVES

1. To experiment with various databases and compose effective queries.
2. To analyze the process of OLAP system construction.
3. To evaluate the use of NOSQL and its approach to the database.
4. To develop applications using Relational and NoSQL databases.
5. To create schema-less databases with NoSQL.

UNIT I – Fundamental Concepts of Database Management (12 Hrs)

1.1 Applications of Database Technology – Key Definitions – File versus Database Approach to Data Management.

1.2 Elements of a Database System – Advantages of Database Systems and Database Management.

1.3 Architecture and Categorization of DBMSs – Conceptual Data Modeling using the ER Model and UML Class Diagram.

1.4 Phases of Database Design – The Entity Relationship Model – UML Class Diagram.

Extra Reading / Keywords: *Data Redundancy, Query Optimization, Client-Server Model.*

UNIT II – Types of Database Systems (12 Hrs)

2.1 Legacy Databases – The Hierarchical Model – The CODASYL Model.

2.2 Relational Databases: The Relational Model – Normalization – Mapping a Conceptual ER Model to a Relational Model.

2.3 Structured Query Language: SQL Data Definition Language (DDL) and Data Manipulation Language (DML).SQL Views, Indexes, Privileges. Metadata Management – SQL DDL and DML Lab.

Extra Reading / Keywords: *Data Anomalies, SQL Subqueries, Data Consistency.*

UNIT III – Mysql Basics and the Mysql Client (12 Hrs)

3.1 The MySQL Client – Connecting to the Server – Exploring Databases.

3.2 Creating Databases and Tables – Inserting Data – Altering Tables.

3.3 Understanding AUTO_INCREMENT, Indexes, and Essential Table Modifications.

3.4 Best Practices in Database Design and Client-Server Interactions.

Extra Reading / Keywords: *Client-server interactions, Database design, Table structure best practices.*

UNIT IV – Mongodb Fundamentals **(12 Hrs)**

4.1 NoSQLOverview – Document Model – Databases, Collections, Documents
4.2 BSON Data Types – CRUD Operations (Insert, Find, Update, Delete)
4.3 Filtering Queries – Operators – Query Criteria
4.4 Basic Indexing – explain() Execution Analysis
Extra Reading / Keywords: Design considerations, JSON vs BSON

UNIT V – Advanced Mongodb Functions **(12 Hrs)**

5.1 Aggregation Pipeline – Stages & Operators
5.2 MapReduce — Concept & Applications
5.3 Replication — Replica Sets Configuration Basics
5.4 Normalization vs Denormalization in NoSQL
Extra Reading / Keywords: *Write concerns, Consistency trade-offs, NoSQL CAP perspective*
Note: Texts given in the Extra Reading / Keywords must be tested only through assignment and seminars.

PRESCRIBED TEXT BOOKS

1. Lemahieu, W., Broucke, S.vanden and Baesens, B. Principles of database management: The Practical Guide to storing, managing and analyzing big and small data. Cambridge University Press, 2018 **.**

UNIT I: Chapter 1, 2, 3
UNIT II: Chapter 5, 6, 7

2. Alkin Tezuysal, Ibrar Ahmed, Ibrar Ahmed, "Database Design and Modeling with PostgreSQL and MySQL", Packt Publishing, 2024.

UNIT III: Chapter 2.

3. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Inc., 2019.

UNIT IV: Chapters 2, 3, 4
UNIT V: Chapter 9

SUGGESTED READINGS

1. Renee M. P. Teate, SQL for Data Scientists: A Beginner's Guide for Building Datasets for Analysis, 2021.
2. Antonio Badia, SQL for Data Science: Data Cleaning, Wrangling and Analytics with Relational Databases, 2020.
3. GuyHarrison, Next Generation Database: NoSQL and Big Data, Apress, 2015.

WEB REFERENCES

1. https://www.geeksforgeeks.org/introduction-to-nosql
2. https://www.kdnuggets.com/introduction-to-databases-in-data-science
3. https://www.datacamp.com/blog/nosql-databases-what-every-data-scientist-needs-to-
4. https://www.researchgate.net/publication/353721422_Databases_for_Data_Science
5. https://www.tutorialspoint.com/sql/sql-databases.htm

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO 1	recognize the fundamental concepts of SQL and noSQL databases.	K1
CO 2	understand the difference between database models and utilize SQL and noSQL for database design and management.	K2
CO 3	apply SQL and noSQL crud operations for real world applications.	K3
CO 4	analyze noSQL database models, trade-offs, and applications of cap theorem.	K4
CO 5	evaluate mongoDB document handling, querying techniques for data management.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	L	H	M	H	M
CO 2	H	M	H	M	M	H	M	H	H
CO 3	H	M	L	H	H	M	H	H	H
CO 4	L	M	L	L	H	H	H	H	M
CO 5	L	M	L	L	M	H	M	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	H	M
CO 4	M	M	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 8: DATABASE TECHNOLOGY – LAB**
Course Code	**P25DS2CCP08**
Course Type	**Practical**
Semester	**II**
Hours / Week	**4**
Total Hours	**60**
Credits	**4**
Marks	**100**

CONSPECTUS

To equip students with both theoretical understanding and practical skills for working with relational and NoSQL databases.

COURSE OBJECTIVES

1. To gain a comprehensive understanding of SQL and PL/SQL for database management.
2. To demonstrate table manipulation using DDL and DML commands.
3. To apply aggregate functions, stored procedures, functions, and triggers to solve real-world database problems and enhance data processing in SQL and PL/SQL.
4. To analyze and evaluate the effectiveness of CRUD operations, simple and type-specific queries, cursors, and indexing in MongoDB.
5. To design and implement an optimized MongoDB solution that integrates efficient CRUD operations and advanced querying.

EXERCISES

MySQL Module

1. DDL, DML queries — Constraints
2. Joins, Subqueries & Views
3. Aggregate Functions & Grouping
4. Indexing & Query Optimization
5. Stored Procedures & Functions
6. Triggers & Cursors

MongoDB Module

7. MongoDB CRUD Operations
8. Filtering Queries & Projection
9. Aggregation Pipeline (group, match, sort)
10. Indexes & Query performance with explain()
11. Replication Basics Demo
12. Mini-Project — MySQL + MongoDB integration

COURSE OUTCOMES

The learners will able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO 1	identify the fundamental principles of database operations, including DDL, DML, and dcl queries.	K1
CO 2	understand the application of aggregate functions, set operations, and normalization techniques in relational databases.	K2
CO 3	implement aggregate functions in MySQL and MongoDB queries.	K3
CO 4	develop, execute, and optimize MySQL and MongoDB programs, including stored procedures, functions, and triggers.	K4
CO 5	evaluate and manage cursors for efficient row-by-row data processing, ensuring robust and efficient database applications.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	L	H	M	H	H	M	M	M
CO 2	H	M	H	H	M	M	M	H	H
CO 3	H	H	M	H	L	M	L	M	H
CO 4	M	M	H	H	M	H	M	H	H
CO 5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	M	H	M
CO 3	L	M	H
CO 4	M	L	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 3 (DISCIPLINE SPECIFIC): EXPLORATORY DATA ANALYSIS**
Course Code	**P25DS2ECT05**
Course Type	**Theory**
Semester	**II**
Hours / Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

This course aims to develop the learner's ability to efficiently use Microsoft Excel as an analytical and decision-making tool. It covers advanced formulas, functions, data management, charts, pivot tables, and macros, enabling learners to perform complex business analysis, automate tasks, and visualize data effectively.

COURSE OBJECTIVES

1. To recall the basic and intermediate concepts of Microsoft Excel.
2. To understand the use of advanced formulas, functions, and data manipulation tools.
3. To apply logical, statistical, and financial functions to perform business computations.
4. To analyse and visualize large datasets using pivot tables, charts, and analytical tools.
5. To automate Excel tasks using macros and develop professional reporting skills.

UNIT I – Excel Fundamentals and Data Operations (12 Hrs)

1.1 Overview of Excel Interface and Navigation.
1.2 Data Entry, Editing, and Saving Workbooks.
1.3 Basic Calculations, Formulas, and Cell Referencing (Absolute and Relative).
1.4 Protecting and Unprotecting Worksheets and Cells; Shortcut Keys.

Extra Reading / Keywords: *Page Setup, Workbook Management, Formatting Techniques*

.

UNIT II – Working with Formulas and Functions (12 Hrs)

2.1 Basic, Logical (IF, AND, OR, NOT), and Statistical Functions (AVERAGE, COUNT, MAX, MIN).
2.2 Lookup Functions (VLOOKUP, HLOOKUP, INDEX, MATCH).
2.3 Financial Functions (PMT, FV, PV, NPER, RATE).
2.4 Text, Date & Time, and Math & Trig Functions.

Extra Reading / Keywords: *IFERROR, Nested IF, Named Ranges, Formula Auditing.*

UNIT III – Data Management and Analysis (12 Hrs)

3.1 Sorting, Filtering, and Subtotal Features.
3.2 Data Validation and What-If Analysis (Goal Seek, Data Tables, Scenario Manager).
3.3 Conditional Formatting and Custom Rules.Data Tools – Text to Columns, Remove Duplicates, and Data Consolidation.

Extra Reading / Keywords: *Flash Fill, Advanced Filters, Wildcard Characters, Data Proofing.*

UNIT IV – Pivot Tables, Charts, and Visualization **(12 Hrs)**

4.1 Creating and Customizing Pivot Tables and Pivot Charts.
4.2 Grouping, Filtering, and Summarizing Data with Pivot Tables.
4.3 Creating Dynamic Charts and Graphs (Column, Line, Pie, Combo).
4.4 Advanced Conditional Formatting and Data Visualization Techniques.
Extra Reading / Keywords: *Data Aggregation, Chart Formatting, Dashboard Elements.*

UNIT V – Automation, Macros, and Advanced Tools **(12 Hrs)**

5.1 Introduction to Macros – Recording and Running Macros.
5.2 Using Solver and Advanced Subtotal Tools.
5.3 Advanced Paste Special, Custom Number Formats, and Auto Formats.
5.4 Securing, Proofing, and Printing Professional Spreadsheets.
Extra Reading / Keywords: *VBA Basics, Automating Reports, Goal Seek vs Solver, Workbook Protection.*

Note: ***Texts given in the Extra Reading / Keywords must be tested only through assignments and seminars.***

PRESCRIBED TEXT BOOKS

1. Wayne Winston, *Microsoft Excel Data Analysis and Business Modeling*, 7th Edition, Microsoft Press, 2022.

UNIT I: Chapters 1–3
UNIT II: Chapters 4–7
UNIT III: Chapters 8–11
UNIT IV: Chapters 12–15
UNIT V: Chapters 16–18

SUGGESTED READINGS

1. Michael Alexander & Dick Kusleika, *Excel 2021 Power Programming with VBA*, Wiley, 2021.
2. John Walkenbach, *Excel 2021 Bible*, Wiley, 2022.
3. Greg Harvey, *Excel 2021 All-in-One for Dummies*, Wiley, 2021.
4. Conrad Carlberg, *Business Analysis with Microsoft Excel*, Pearson, 2019.

WEB REFERENCES

1. https://support.microsoft.com/excel
2. https://www.excelcampus.com
3. https://www.datacamp.com
4. https://exceljet.net

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO 1	recognize and use advanced excel interface, tools, and shortcuts efficiently.	K1
CO 2	explain and apply advanced formulas and functions for business analytics.	K2
CO 3	apply data management tools for sorting, validation, and analysis.	K3
CO 4	analyze data using pivot tables and visualize results through dynamic charts.	K4
CO 5	create automated reports and analytical dashboards using macros and solver tools.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	L	M	H	M	L	M
CO 2	H	H	M	M	M	H	M	H	M
CO 3	M	H	H	M	M	M	H	H	H
CO 4	H	H	H	M	H	H	H	H	L
CO 5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	H	M
CO 4	H	H	M
CO 5	M	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	ELECTIVE COURSE 3 (DISCIPLINE SPECIFIC): SOCIAL MEDIA ANALYTICS
Code	P25DS2ECT06
Course Type	Theory
Semester	II
Hours/Week	4
Total Hours	60
Credits	3
Marks	100

CONSPECTUS

To enable the students to gain fundamental knowledge and practical tools for social media analytics, focusing on text analysis, user actions, and hyperlink analysis to extract actionable business insights and drive data-informed decision-making.

COURSE OBJECTIVES

1. To Understand the evolution and core characteristics of social media platforms.
2. To Interpret the layers and types of analytics specific to social media.
3. To Apply text analysis tools for extracting insights from social media content.
4. To Analyze social media actions for interpreting user engagement patterns.
5. To Evaluate hyperlink analytics for identifying trends and viral content on platforms like YouTube.

UNIT I - Introduction to social media **(12 Hrs)**

1.1 World Wide Web, Web 1.0, Web 2.0, Web 3.0
1.2 Characteristics of Social Media
1.3 Types of Social Media
1.4 Social Networking Sites Using Facebook for Business Purposes
Extra Reading / Keywords: *Network Effects, User-Generated Content, Engagement Strategies, Influencer Marketing*

UNIT II - Social media analytics overview **(12 Hrs)**

2.1 Purpose of Social Media Analytics
2.2 Social Media Vs. Traditional Business Analytics
2.3 Seven Layers of Social Media Analytics
2.4 Types of Social Media Analytics, Social Media Analytics Cycle
2.5 Challenges to Social Media Analytics and Social Media Analytics Tools.
Extra Reading / Keywords: *Sentiment Analysis, Engagement Metrics, Multi-Channel Analysis, Data-Driven Marketing*

UNIT III - Social Media Text Analytics **(12 Hrs)**

3.1 Types of Social Media Text
3.2 Purpose of Text Analytics
3.3 Steps in Text Analytics
3.4 Social Media Text Analysis Tools.
Extra Reading / Keywords: *Topic Modeling, Word Embeddings, Named Entity Recognition, Opinion Mining*

UNIT IV - Social Media Actions Analytics **(12 Hrs)**

4.1 Introduction to Actions Analytics
4.2 Common Social Media Actions
4.3 Actions Analytics Tools.

Extra Reading / Keywords: *User Behavior Patterns, A/B Testing, Influencer Actions, Social Media Impact*

UNIT V - Social media hyperlink analytics **(12 Hrs)**

5.1 Types of Hyperlinks
5.2 Hyperlink Analytics
5.3 Types of Hyperlink Analytics
5.4 Hyperlink Analytics Tools.

Extra Reading / Keywords: *Link Influence, Hyperlink Networks, Inbound vs. Outbound Links, Link Authority*

PRESCRIBED TEXT BOOKS

1. Seven Layers of Social Media Analytics Mining Business Insights From Social Media Text,Actions, Networks, Hyperlinks, Apps, Search Engine, And Location Data By Gohar F. Khan Isbn: 1507823207, Isbn-13: 9781507823200, 2022.

UNIT I: Chapter 1, 2
UNIT II: Chapter 3, 4, 5, 8
UNIT III: Chapter 6, 8
UNIT IV: Chapter 7, 8
UNIT V: Chapter 9,10

SUGGESTED READINGS

1. Social Media Analytics: Techniques and Insights For Extracting Business Value out of Social Media By Matthew Ganis, Avinash Kohirkar, Pearson Education., 2016.
2. Social Media Analytics: Effective Tools for Building, Interpreting, and Using Metrics, Marshall Sponder, MGH, 2011.
3. Big Data and Analytics, Seema Acharya, Subhasinin Chellappan, Wiley Publications, 2015.
4. Big Data, Black Booktm , Dreamtech Press, 2015.

WEB REFERENCES

1. https://byjus.com/gate/difference-between-web-1-0-web-2-0-and-web-3-0/
2. https://sproutsocial.com/
3. https://www.geeksforgeeks.org/what-is-text-analytics/
4. https://sproutsocial.com/insights/social-media-analytics-tools

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO 1	recall the layers of social media analytics.	K1
CO 2	describe the characteristics and types of social media.	K2
CO 3	implement text analysis tools to process and analyze social media data	K3
CO 4	examine and determine patterns to identify viral topics based on data.	K4
CO 5	assess and justify the importance of action analytics in social media based on its impact on user engagement and business outcomes	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	M	M	H	L	M	H	H	L	M
CO 2	H	L	M	M	H	M	M	H	L
CO 3	L	H	H	M	L	L	M	H	H
CO 4	M	H	L	H	H	M	H	M	H
CO 5	H	M	M	H	M	L	H	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	M	H	L
CO 2	H	M	M
CO 3	M	L	H
CO 4	H	M	M
CO 5	M	H	L

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 4 (GENERIC): PYTHON FOR DATA ANALYTICS**
Course Code	**P25DS2ECT07**
Course Type	**Theory**
Semester	**II**
Hours / Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To develop logical thinking and programming skills through Python's fundamental constructs, including control structures, functions, collections, and data science libraries such as NumPy and Pandas for mathematical applications.

COURSE OBJECTIVES

1. To recall the concept of Python data types and basic coding structures.
2. To understand the role of control flow and functions in program logic.
3. To apply Python data structures such as lists, tuples, and dictionaries.
4. To analyze numerical computations using NumPy arrays.
5. To evaluate and manipulate data using Pandas for mathematical and statistical operations.

UNIT I - Data Types, Expressions, Statements **(12 Hrs)**

1.1 Python Interpreter and Interactive Mode – Debugging
1.2 Values and Types – int, float, boolean, string, list
1.3 Variables – Expressions – Statements – Tuple Assignment
1.4 Operator Precedence – Comments

Use Case: Building simple calculators

Extra Reading / Keywords: *Debugging Techniques, Numeric Operations*

UNIT II - Control Flow, Functions And Strings **(12 Hrs)**

2.1 Conditionals – Boolean Expressions – if, if-else, if-elif-else
2.2 Iteration – while, for, break, continue, pass
2.3 Strings – Slicing – Immutability – String Functions & Methods
2.4 User-defined Functions – Parameters – Return Values

Use Case: Login authentication using conditionals

Extra Reading / Keywords: *Regular Expressions Basics*

UNIT III - Lists, Tuples and Dictionaries **(12 Hrs)**

3.1 Lists Operations – Slicing – Methods – Mutability
3.2 Aliasing – Cloning Lists – List Comprehension
3.3 Tuples – Packing & Unpacking – Tuples as Return Values
3.4 Dictionaries – Key-Value Store – Dictionary Methods

Use Case: Student records management (using lists & dictionaries)

Extra Reading / Keywords: *Mutable vs Immutable Types*

UNIT IV - Numpy for mathematical computing **(12 Hrs)**

4.1 ndarray – Creation – Data Types – Mathematical Operations
4.2 Indexing & Slicing – Boolean & Fancy Indexing
4.3 Transposing Arrays – Swapping Axes
4.4 Random Number Generation

Use Case: Statistical simulations (mean, std, random number generation).
Extra Reading / Keywords: *Linear Algebra Functions, Statistical Arrays*

UNIT V – Data Analysis Using Pandas **(12 Hrs)**

5.1 Series and DataFrame Structures
5.2 Reindexing – Dropping Entries – Sorting
5.3 Data Selection, Filtering, Arithmetic Alignment
5.4 Mapping Functions – Ranking – Handling Missing Data

Use Case: Sales/finance data analysis (sorting, filtering, ranking).
Extra Reading / Keywords: *Time Series Basics, GroupBy Introduction*

Note: Texts given in the Extra Reading / Keywords must be tested only through Assignment and Seminar.

PRESCRIBED TEXT BOOKS

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
   UNIT I: Chapter 1,2
   UNIT II: Chapter 3, 5, 8
   UNIT III: Chapter 10, 11, 12
2. Wes McKinney, "Python for Data Analysis: Data wrangling with pandas, NumPy & jupyter", 3rd Edition, O'Reilly Publishers, 2022.
   UNIT I: Chapter 4
   UNIT V: Chapter 5

SUGGESTED READINGS

1. Paul Deitel and Harvey Deitel, "Python for Programmers", 1st Edition Pearson Education, 2021.
2. Vander Plas J, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly Media Publishers, 2016
3. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
4. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modelling and Understanding Data", Third Edition, MIT Press, 2021

WEB REFERENCES

1. https://realpython.com/
2. https://towardsdatascience.com/
3. https://jupyter.org/
4. https://www.javatpoint.com/python-tutorial
5. https://www.w3schools.com/python/

COURSE OUTCOMES
The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1- K5)
CO 1	identify the core concepts of python data types and their usage.	K1
CO 2	explain control flow techniques used to create interactive python programs.	K2
CO 3	apply lists, tuples, and dictionaries to solve programming problems.	K3
CO 4	examine array-based mathematical operations using numpy.	K4
CO 5	design data analysis solutions by manipulating data with pandas.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING
PO-CO MAPPING

CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	H	L	H	M	H	M
CO 2	H	M	H	M	M	H	M	H	H
CO 3	H	M	L	H	H	M	H	H	H
CO 4	L	M	L	L	H	H	H	H	M
CO 5	L	M	L	L	M	H	M	M	H

PSO-CO MAPPING

CO \ PSO	PSO1	PSO2	PSO3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	H	M
CO 4	M	M	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	ELECTIVE COURSE 4(GENERIC): ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING – LAB
Code	P25DS2ECP08
Course Type	Practical
Semester	II
Hours/Week	4
Total Hours	60
Credits	3
Marks	100

CONSPECTUS

Acquire computational knowledge using novel tools and methodologies to tackle challenges in the fields related to Machine learning, Artificial Intelligence.

COURSE OBJECTIVES

1. To explore the fundamental issues and Machine Learning including data selection and model selection and complexity.
2. To underlying mathematical relationship within and across AI and Machine Learning Algorithms.
3. To evaluate the various supervised Learning algorithms using appropriate dataset
4. To evaluate the various unsupervised Learning algorithms using appropriate dataset
5. To apply and analyze the various Machine Learning algorithms in the range of Real world application.

EXERCISES

1. Program to implement Uniformed Search Technique: Breadth First Search
2. Program to implement Uniformed Search Technique: Depth First Search
3. Introduction of various python libraries used for machine learning.
4. Find statistical measures such as mean, median and mode of the given data
5. Find statistical measures such as standard Deviation and Variance of the given data
6. Implement program to perform Dimension reduction of High Dimension data
7. Implement program to understand similarity measures and dissimilarity measures.
8. Supervised data compression via linear discriminate analysis
9. Implement Linear Regression model and Evaluate Model performance
10. Implement Logistic Regression model and Evaluate Model performance

COURSE OUTCOMES
The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1- K5)
CO 1	depict the different python libraries to implement the code	K1
CO 2	demonstrate the supervised algorithms in the real time dataset	K2
CO 3	illustrate the unsupervised algorithms in the real time dataset	K3
CO 4	demonstrate working knowledge of reasoning in the presence of incomplete and or uncertain information.	K4
CO 5	apply ml, AI techniques and technologies to solve real world business problems.	K5

MAPPING
PO- CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	H	H	M	L	H	H	H
CO 2	M	M	M	M	H	M	H	M	L
CO 3	H	M	H	M	H	L	H	M	H
CO 4	H	H	M	M	H	M	H	H	H
CO 5	M	M	H	H	H	L	H	M	M

PSO–CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	M	M	H
CO 3	M	M	M
CO 4	H	H	H
CO 5	H	M	M

(For candidates admitted in the academic year 2025-26)

Course Title	NON MAJOR ELECTIVE 1:VISUAL ANALYTICS FOR BUSINESS INTELLIGENCE – LAB
Course Code	P25DS2SEP01
Course Type	Practical
Semester	II
Hours / Week	4
Total Hours	60
Credits	2
Marks	100

CONSPECTUS

To understand and implement data visualization techniques using Tableau and Power BI. Learners will gain practical exposure to connecting data sources, creating interactive dashboards, and analysing data through visualizations.

COURSE OBJECTIVES

1. To understand the interface, components, and features of Microsoft Power BI.
2. To import and transform data from multiple data sources in Power BI.
3. To apply DAX functions and visualization components to analyze business data.
4. To construct interactive dashboards using drill-down, filtering and AI-assisted tools.
5. To publish and manage reports using Power BI Service for collaborative analytics.

EXERCISES

1. Introduction to Power BI Desktop – Interface, Data view, Report view, Model view.
2. Importing Data – Excel, CSV, Web data – Data transformation using Power Query Editor.
3. Creating basic visualizations – Bar, Column, Line, Pie, Area, Scatter.
4. Advanced visualizations – Maps, Tree map, Funnel, Gauge, KPI, Cards.
5. Applying Filters, Slicers, Drill-down & Drill-up actions.
6. Relationships between tables – Join types – Star/Snowflake schema.
7. Creating calculated columns & Measures using DAX.
8. Time Intelligence functions – Trend analysis & Forecasting.
9. Clustering, Grouping, and AI Insights.
10. Creating Interactive Dashboards – Navigation, Bookmarks & Tooltips.
11. Publish and share reports to Power BI Service – Access permissions.
12. Real-time dashboards using Streaming datasets / Power Apps integration.

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO 1	recognize power BI environment, components, and data access	K1
CO 2	work with data import, cleaning and modeling	K2
CO 3	apply dax and visual analytics for business problems	K3
CO 4	analyze interactive dashboards using drill-down and ai tools	K4
CO 5	present insights through published dashboards in power bi service	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	L	H	M	H	H	M	M	M
CO 2	H	M	H	H	M	M	M	H	H
CO 3	H	H	M	H	L	M	L	M	H
CO 4	M	M	H	H	M	H	M	H	H
CO 5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	M	H	M
CO 3	M	M	H
CO 4	M	L	H
CO 5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 9: DEEP LEARNING**
Course Code	**P25DS3CCT09**
Course Type	**Theory**
Semester	**III**
Hours/Week	**5**
Total Hours	**75**
Credits	**5**
Marks	**100**

CONSPECTUS

To equip students with a comprehensive understanding of deep learning concepts, architectures, and techniques, enabling them to design, train, evaluate, and deploy advanced neural network models for real-world applications.

COURSE OBJECTIVES

1. To understand the fundamental concepts of neural networks, activation functions, regularization techniques, and hyperparameter tuning.
2. To learn the architecture and working of deep learning models including CNNs, RNNs, Autoencoders, GANs, and Transformers.
3. To apply TensorFlow for building and training deep learning models for image, text, and sequence data.
4. To analyze and evaluate deep learning models using optimization techniques, data augmentation, and performance improvement strategies.
5. To explore real-world applications of deep learning such as image recognition, text generation, sentiment analysis, and generative modeling.

UNIT I - Introduction To Neural Networks (15 Hrs)

1.1 Perceptron Our first example of TensorFlow code - Multi-layer perceptron: our first example of a network - Problems in training the perceptron and solution

1.2 Activation function: sigmoid – tanh – ReLU - Two additional activation functions: ELU and Leaky ReLU

1.3 Regularization - Adopting regularization to avoid overfitting - Understanding batch normalization

1.4 Hyperparameter tuning and AutoML - A practical overview of backpropagation.

Extra Reading / Keywords: Gradient Descent Optimization, Weight Initialization Techniques, Overfitting vs Under fitting

UNIT II - Convolutional Neural Networks (15 Hrs)

2.1 Deep convolutional neural networks Local receptive fields - Shared weights and bias - ConvNets in TensorFlow - Pooling layers - Max pooling - Average pooling - ConvNets

2.2 DCNN: LeNet - LeNet code in TF - Recognizing CIFAR-10 images with deep learning - Improving the CIFAR-10 performance with data augmentation - Predicting with CIFAR-10 - Very deep convolutional networks for large-scale image recognition

2.3 Other CNN architectures AlexNet - Residual networks - HighwayNets and DenseNets.

Extra Reading / Keywords: Transfer Learning, Image Augmentation Techniques, Object Detection Basic

UNIT III - Recurrent Neural Networks **(15 Hrs)**

3.1 The basic RNN cell Backpropagation through time (BPTT) - Vanishing and exploding gradients - RNN cell variants

3.2 Long short-term memory (LSTM) - Gated recurrent unit (GRU) - Peephole LSTM - RNN variants -Bidirectional RNNs - Stateful RNNs

3.3 RNN topologies – One-to-many – Learning to generate text – Many-to-one – Sentiment analysis – Many-to-many – POS tagging - Encoder-decoder architecture – seq2seq.

Extra Reading / Keywords: Sequence Modelling, Attention Mechanism in RNN context, Time Series Forecasting

UNIT IV - Autoencoders And Gan **(15 Hrs)**

4.1 Introduction to autoencoders - Vanilla autoencoders - Reconstructing handwritten digits using an autoencoder - Sparse autoencoder - Denoising autoencoders - Clearing images using a denoising autoencoder - Stacked autoencoder - Convolutional autoencoder for Variational autoencoders

4.2 Generative Models - MNIST using GAN in TensorFlow - Contents Deep convolutional GAN (DCGAN) DCGAN for MNIST digits

4.3 Some interesting GAN architectures – CycleGAN – InfoGAN - Cool applications of GANs - CycleGAN in TensorFlow

Extra Reading / Keywords: Representation Learning, Generative Modelling Applications, Image-to-Image Translation

UNIT V - Transformers Architecture **(15 Hrs)**

5.1 An overview of the transformer architecture - Training - Transformers' architectures

5.2 An overview of popular and well-known models - BERT - GPT-2 ,GPT

5.3 The future of transformers

Extra Reading / Keywords: Self-Attention Mechanism, Large Language Models (LLMs), Multimodal AI

Note: Texts given in the Extra Reading/Keywords must be tested only through assignment and seminar.

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO 1	Recall and explain the fundamental concepts of neural networks, activation functions, regularization, and hyperparameter tuning.	**K1**
CO 2	Understand and describe the working principles of CNN, RNN, Autoencoders, GANs, and Transformer architectures	**K2**
CO 3	Apply TensorFlow to build and implement deep learning models such as CNN, RNN, Autoencoders, GANs, and Transformers.	**K3**
CO 4	Evaluate deep learning model performance using optimization techniques, data augmentation, and architectural improvements.	**K4**
CO 5	Develop solutions for real-world applications such as image recognition, text generation, sentiment analysis, and generative modeling using deep learning	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

PRESCRIBED TEXT BOOK

1. Amita Kapoor Antonio Gulli Sujit Pal Deep Learning with TensorFlow and Keras (Third Edition), 2022.
   UNIT 1: chapter 1
   UNIT 2: chapter 3
   UNIT 3: Chapter 5
   UNIT 4: chapter 8& 9
   UNIT 5: chapter 6

SUGGEST READINGS

1. Francois Chollet. Deep Learning with Python. 1ed, Manning Publications, 2017. ISBN 978-1617294433.
2. Nikhil Buduma, Nicholas Locascio. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms. O'Reilly Media. 2017.
3. SantanuPaatanayak, Pro Deep Learning with TensorFlow - A mathematical Approach to Advanced Artificial Intelligence in Python (Adaptive Computation and Machine Learning series), (electronic): 978-1-4842-3096-1, Library of Congress Control Number: MIT Press, 2017.

WEB REFERENCES

1. https://www.deeplearning.ai/resources/
2. https://www.datacamp.com/tutorial/tutorial-deep-learning-tutorial
3. https://www.dataquest.io/blog/tutorial-introduction-to-deep-learning/
4. https://pyimagesearch.com/category/deep-learning/
5. https://github.com/tensorflow

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	H	M	M	M	M	L	L	M
CO 2	H	H	H	M	H	M	M	M	M
CO 3	H	H	H	M	H	M	M	M	L
CO 4	H	H	M	H	H	H	M	H	M
CO 5	H	H	H	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	H	H	M
CO 3	H	H	M
CO 4	M	H	H
CO 5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 10: DEEP LEARNING– LAB**
Course Code	**P25DS3CCP10**
Course Type	**Practical**
Semester	**III**
Hours/Week	**5**
Total Hours	**75**
Credits	**4**
Marks	**100**

CONSPECTUS

To understand the fundamental concepts of Deep Learning using TensorFlow and gain practical experience in designing, developing, deploying Deep Learning models, including Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN), for real-time application

COURSE OBJECTIVES

1. To learn the basic features of Deep Learning algorithms.
2. To understand the different Deep Learning models with TensorFlow.
3. To implement Deep Learning model with RNN using TensorFlow
4. To analyze appropriate algorithms to develop models with CNN.
5. To evaluate Deep Learning models to predict real time applications

EXERCISES

1. Implement a Single Layer Perceptron for binary classification using TensorFlow.
2. Build a Multi-Layer Perceptron (MLP) for MNIST digit classification and compare activation functions (Sigmoid, Tanh, ReLU, and Leaky ReLU).
3. Apply Regularization and Batch Normalization to improve MLP performance and perform basic hyperparameter tuning.
4. Implement a basic CNN for MNIST image classification using convolution and pooling layers.
5. Implement LeNet architecture for CIFAR-10 image classification.
6. Improve CNN performance using data augmentation and transfer learning with a pretrained model.
7. Implement a simple RNN for text classification.
8. Build an LSTM/GRU model for sentiment analysis on a text dataset.
9. Implement RNN for time series forecasting (temperature/stock dataset).
10. Implement a Vanilla Autoencoder to reconstruct MNIST images.
11. Implement a Denoising Autoencoder to remove noise from images.
12. Build a DCGAN to generate handwritten digit images.

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1- K5)
CO 1	Remember the fundamental concepts and features of deep learning algorithms.	**K1**
CO 2	Compare and contrast different deep learning models using TensorFlow	**K2**
CO 3	Design and implement deep learning models with recurrent neural networks (RNN) using TensorFlow	**K3**
CO 4	Analyze and select appropriate algorithms to develop models using convolutional neural networks (CNN).	**K4**
CO 5	Evaluate the performance of deep learning models for real-time applications	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	M	H	M	L	L	M
CO 2	H	H	H	M	H	M	M	M	M
CO 3	H	H	H	H	H	M	M	M	M
CO 4	H	H	H	H	H	H	M	H	M
CO 5	H	H	H	H	H	H	H	H	H

PSO – CO MAPPING

CO /PSO	PSO1	PSO2	PSO3
CO 1	H	M	M
CO 2	H	H	M
CO 3	H	H	H
CO 4	M	H	H
CO 5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 11: FULL STACK DEVELOPMENT**
Course Code	**P25DS3CCT11**
Course Type	**Theory**
Semester	**III**
Hours/Week	**5**
Total Hours	**75**
Credits	**4**
Marks	**100**

CONSPECTUS

To provide comprehensive theoretical knowledge of full stack web development covering front- end technologies, back-end development, databases, APIs, security, testing, and deployment practices required for building scalable web applications.

COURSE OBJECTIVES

1. To recall the fundamentals of web architecture and full stack development concepts.
2. To explain front-end technologies, frameworks, and user interface design principles.
3. To describe back-end development, server-side programming, and API design.
4. To analyze database design, integration, and data management techniques.
5. To design secure, scalable, and maintainable full stack web applications.

UNIT I - Javascript and Basics of Mern Stack **(15 Hrs)**

1.1 JavaScript Fundamentals – Objects – Generators – Advanced Iteration – Modules
1.2 DOM Tree – Node Properties – Browser Events – Event Delegation – UI Events
1.3 Forms and Controls – Document Loading – Mutation Observer
1.4 Event Loop – Microtasks and Macrotasks – MERN Stack Components – React – Node.js – Express – MongoDB – Server Setup – npm

Extra Reading / Keywords: JavaScript Objects, Generators, Modules, DOM, Event Loop, MERN Stack, Node.js, npm

UNIT II – React **(15 Hrs)**

2.1 React Introduction – ES6 – Rendering HTML – JSX
2.2 Components – Class Components – Functional Components – Composition
2.3 Props and State – State Management – Event Handling
2.4 Forms – Styling – Stateless Components – Component Design

Extra Reading / Keywords: React JSX, Components, Props, State, Forms, Event Handling

UNIT III – Node.Js and Express **(15 Hrs)**

3.1 Node.js Basics – Modules – npm – Web Server – File System
3.2 EventEmitter – Frameworks – Express.js Applications
3.3 Routing – Middleware – REST APIs – HTTP Methods – JSON
3.4 Error Handling – Template Engines – Testing APIs

Extra Reading / Keywords: Node.js, Express, Middleware, Routing, REST API, JSON

UNIT IV – Mongodb **(15 Hrs)**

4.1 Building MongoDB Environment – Installation – Configuration – User Accounts – Authentication – Access Control

4.2 Administering Databases – Database Creation – Managing Users and Roles – Backup and Restore

4.3 Collections and Data Operations - Managing Collections – Document Structure – CRUD Operations (Insert, Read, Update, Delete) – Data Handling

4.4.Connecting to MongoDB from Node.js – Database Connectivity – Simple Application DevelopmentCloud Databases

Extra Reading / Keywords: *MySQL vs MongoDB, ORM Concepts, Data Validation, Schema Design*

UNIT V – Advanced Features **(15 Hrs)**

5.1 Webpack – React Router – Forms – UI Components

5.2 API Integration – Update and Delete APIs – React Bootstrap

5.3 Server Rendering – State Handling – Pagination – Aggregation

5.4 Authentication – Google Sign-In – Session Handling

Extra Reading / Keywords: React Router, Authentication, Session Management, Deployment, CI/CD

Note: Texts given in the Extra Reading / Keywords must be assessed only through assignments and seminars.

PRESCRIBED TEXT BOOKS

1. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, A Press Publisher, 2019.

UNIT I : Chapter 1, 2

UNIT II : Chapter 3, 4, 5, 6

UNIT III : Chapter 7, 8, 9

UNIT V : Chapter 12, 13, 14

2. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018

UNIT IV : Chapter 6, 7, 8

SUGGESTED READINGS

1. Freeman, E. (2019). Head First JavaScript Programming. O'Reilly.
2. Sebesta, R. (2018). Programming the World Wide Web. Pearson.
3. Newman, S. (2021). Building Microservices. O'Reilly.

WEB REFERENCES

1. http://tutorialsteacher.com
2. https://reactjs.org/
3. https://nodejs.org
4. www.Expressjs.com
5. www.mongodb.com

COURSE OUTCOMES

The learners will be able to

CO. No.	Course Outcomes	Cognitive Level (K1 – K5)
CO-1	Identify core concepts of full stack development and web architecture.	**K1**
CO-2	Explain front-end and back-end technologies used in web applications.	**K2**
CO-3	Apply full stack tools and frameworks to design web-based solutions.	**K3**
CO-4	Analyze database design, security, and testing strategies for web systems.	**K4**
CO-5	Evaluate and design scalable, secure full stack applications.	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	M	L	M	M	L	L	M
CO2	H	H	H	M	H	M	M	M	M
CO3	H	H	H	M	H	M	M	M	M
CO4	H	H	M	H	H	M	M	M	M
CO5	H	H	H	H	H	H	M	H	H

PSO – CO MAPPING

CO / PSO	PSO1	PSO2	PSO3
CO1	H	M	M
CO2	H	H	M
CO3	H	H	H
CO4	H	H	M
CO5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 12: FULL STACK DEVELOPMENT – LAB**
Course Code	**P25DS3CCP12**
Course Type	**Practical**
Semester	**III**
Hours/Week	**5**
Total Hours	**75**
Credits	**4**
Marks	**100**

CONSPECTUS

This course provides hands-on training in web development using HTML, CSS, JavaScript, jQuery, Node.js, and Angular. It focuses on building dynamic, interactive applications with skills in DOM manipulation, validation, and component-based design.

COURSE OBJECTIVES

1. To understand and apply HTML, CSS, and JavaScript for creating structured and styled web pages.
2. To implement client-side interactivity using JavaScript functions, DOM manipulation, and event handling.
3. To perform input validation and dynamic content handling using JavaScript and jQuery.
4. To develop backend functionalities using Node.js, including external HTTP requests and URL parsing.
5. To build interactive single-page applications using Angular with TypeScript and component-based architecture.

EXERCISES

1. HTML elements, tags, and attributes
2. CSS styling and layout techniques
3. JavaScript functions and DOM manipulation
4. Event handling and form validation
5. jQuery-based web page manipulation
6. Node.js server creation
7. HTTP requests and API handling
8. URL parsing using Node.js
9. React component development
10. State and props implementation
11. REST API integration
12. Full stack mini project

COURSE OUTCOMES

The learners will be able to

CO. No.	Course Outcomes	Cognitive Level (K1 – K5)
CO 1	Identify the fundamental concepts, tools, and technologies used in front-end and back-end web development.	**K1**
CO 2	Explain the structure and functionality of client-side and server-side components in full stack applications.	**K2**
CO 3	Apply programming languages, frameworks, and databases to design and develop interactive web applications.	**K3**
CO 4	Analyze the integration of front-end, back-end, and database components to ensure seamless application performance.	**K4**
CO 5	Evaluate and deploy full stack web solutions for real-time problems across various domains using appropriate development environments.	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	M	M	H	L	M	M	L	L	M
CO 2	M	H	H	M	H	M	M	M	M
CO 3	H	H	H	M	H	M	M	M	M
CO 4	H	H	H	H	H	M	M	M	H
CO5	H	H	H	H	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	M	M	M
CO 2	H	H	M
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**COR COURSE 13 (INDUSTRIAL MODULE): BUSINESS ANALYTICS**
Course Code	**P25DS3CCT13**
Course Type	**Theory**
Semester	**III**
Hours/Week	**4**
Total Hours	**60**
Credits	**4**
Marks	**100**

CONSPECTUS

To understand the concepts, processes, techniques, and applications of business analytics and data science, including data mining, predictive modelling, forecasting, and data-driven decision making for solving real-world business problems.

COURSE OBJECTIVES

1. To understand the fundamentals of business analytics and different types of analytics
2. To explore data science processes and techniques for solving business problems
3. To analyse data using statistical, machine learning, and data mining methods
4. To apply forecasting techniques for business decision making
5. To develop data-driven strategies for achieving competitive advantage in organizations

UNIT I - Introduction **(12 Hrs)**

1.1. Evolution of Business Analytics - Descriptive, Predictive, and Prescriptive Analytics
1.2. Data for Business Analytics - Models in Business Analytics
1.3. Problem Solving with Analytics

Extra Reading / Keywords: *Business Intelligence, Analytics Lifecycle, Decision Support Systems, Data-driven Decision Making*

UNIT II - Business Problems and Data Science Solutions **(12 Hrs)**

2.1. From Business Problems to Data Mining Tasks-Supervised Versus Unsupervised Methods- Data Mining and its Results-The Data Mining Process-
2.2. Business Understanding-Data Understanding - Data Preparation- Modeling – Evaluation -Deployment
2.3. Implications for Managing the Data Science Team-Software skills versus Analytics Skills-Other Analytics and Technologies
2.4. Database Querying-Data Warehousing-Regression Analysis-Machine Learning and Data Mining.

Extra Reading / Keywords: *CRISP-DM Framework, Data Mining Techniques*

UNIT III – Fitting a Model to Data **(12 Hrs)**

3.1. Classification via mathematical function -Linear Discriminant Functions
3.2. Optimizing an objective function – Minning a linear discriminant from data
3.3. Linear discriminant functions for scoring and Ranking instances – regression via mathematical functions - class probability estimation and logistic regression
3.4. Non-Linear functions, support vector machines and neural networks

Extra Reading / Keywords: *Classification Algorithms, Regression Models, Model Evaluation Metrics, Overfitting & Underfitting, Feature Engineering*

UNIT IV – Forecasting Techniques **(12 Hrs)**

4.1. Qualitative and Judgement forecasting - Historical Analogy - The Delphi Method – Indicators and Indexes - Statistical Forecasting Models

4.2. Forecasting models for stationary Time series - Moving Average Models - Error Metrics and Forecast Accuracy - Exponential Smoothing Models

4.3. Forecasting models for Time series with linear trend - Double Exponential Smoothing - Regression-Based Forecasting for Time Series with a Linear Trend

4.4. Forecasting time series with Seasonality - Regression-Based Seasonal Forecasting Models - Holt-Winters Models for Forecasting Time Series with Seasonality and No Trend - Holt-Winters Models for Forecasting Time Series with Seasonality and Trend - Selecting Appropriate Time-Series-Based Forecasting Models

Extra Reading / Keywords: *ARIMA Models, Exponential Smoothing, Trend Analysis, Seasonality Decomposition*

UNIT V – Data Science and Business Strategy **(12 Hrs)**

5.1 Achieving competitive advantage with data science – sustaining competitive advantage with data science - Formidable historical advantage

5.2 Unique Intellectual Property – Unique intangible collateral Assets - Superior data scientist – superior data science management

5.3 Attracting and nurturing data scientist and their teams - Examine Data Science case studies – Accept creative Ideas from any source – Evaluate proposals for data science projects

5.4 Data mining proposal – Targeted Whiz – bang customer migration – prepared by Big Red Consulting – Flaws in the Big Red proposal – A firm's data Science maturity

Extra Reading / Keywords: *Competitive Analytics, Data Governance, Business Strategy Analytics, Decision Intelligence*

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1 – K5)
CO 1	Identify fundamentals of business analytics and types of analytics	**K1**
CO 2	Describe data science processes and techniques to solve business problems	**K2**
CO 3	Analyze and interpret data using classification, regression, and machine learning models.	**K3**
CO 4	Design and implement forecasting models and analytical solutions for business decision making	**K4**
CO 5	Develop data-driven strategies to solve real-world business problems and gain competitive advantage	**K5**

(K1=Remember, K2 =Understand, K3=Apply, K4=Analyse, K5=Evaluate)

PRESCRIBED TEXT BOOKS

1. James R. Evans,Business Analytics methods, models and decisions", Pearson Publications, 2021
   UNIT I : Chapter 1
   UNIT IV: Chapter 9
2. Dr. D. I. George Amalarethinsm, Business Intelligence Analytics and Data Science. Alpha Publication 2023.
   UNIT II: Chapter 2
   UNIT III: Chapter 4
   UNIT V : Chapter 9

SUGGESTED READINGS

1. Foster Provost, Tom Fawcett,"Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" (2nd Edition), O'Reilly Media, 2023.
2. V. Kumar, Werner Reinartz,"Customer Relationship Management: Concept, Strategy, and Tools" (3rd Edition), Springer, 2022.
3. Galit Shmueli, Peter C. Bruce, Inbal Yahav, Nitin R. Patel, Kenneth C. Lichtendahl Jr., "Data Mining for Business Analytics: Concepts, Techniques, and Applications", Wiley, 2023.
4. Rob J Hyndman, George Athanasopoulos, "Forecasting: Principles and Practice" (3rd Edition), OTexts, 2021**.**

WEB REFERENCES

1. https://www.kaggle.com/learn
2. https://www.coursera.org/specializations/business-analytics
3. https://otexts.com/fpp3/
4. https://www.ibm.com/analytics
5. https://www.analyticsvidhya.com/

MAPPING:
PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	L	L	M	M	L	L	M
CO 2	H	H	M	M	H	M	M	M	M
CO 3	H	H	H	H	H	M	M	M	M
CO 4	H	H	H	H	H	H	M	H	M
CO 5	H	H	H	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	L
CO 2	H	H	M
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 5 (GENERIC): FUNDAMENTALS OF BIG DATA ANALYTICS**
Code	**P25DS3ECT09**
Course Type	**Theory**
Semester	**III**
Hours / Week	**3**
Total Hours	**45**
Credits	**3**
Marks	**100**

CONSPECTUS

This course introduces the fundamental concepts of Big Data Analytics and distributed computing frameworks. It covers Hadoop ecosystem, HDFS, MapReduce, HBase, NoSQL databases such as MongoDB and Cassandra, and data warehousing tools like Hive and Pig.

COURSE OBJECTIVES

1. To understand the evolution, characteristics, and challenges of Big Data.
2. To explore Hadoop ecosystem and distributed file system architecture.
3. To analyze MapReduce framework and HBase for large-scale processing.
4. To understand NoSQL databases including MongoDB and Cassandra.
5. To implement big data querying solutions using Hive and Pig.

UNIT I – Overview of Big Data (9 Hrs)

1.1 Evolution of Data Management - Definition of Big Data
1.2 Characteristics of Big Data (5Vs)
1.3 Traditional Data vs Big Data - Applications of Big Data in various sectors

Extra Reading / Keywords: 5Vs of Big Data, Data Lakes, Edge Computing

UNIT II – Big Data Technologies and Architecture (9 Hrs)

2.1 Overview of Hadoop Ecosystem - Hadoop Distributed File System (HDFS) – Concept
2.2 MapReduce Programming Model
2.3 Introduction to Apache Spark - Cloud Platforms for Big Data

Extra Reading / Keywords: Distributed Computing, Hadoop Ecosystem, Cloud-Based Processing

UNIT III – Big Data Analytics Techniques (9 Hrs)

3.1 Descriptive, Predictive and Prescriptive Analytics - Data Mining in Big Data
3.2 Text Analytics - Web Analytics
3.3 Real-time Analytics - Introduction to NoSQL Databases

Extra Reading / Keywords: Shuffle Phase, Data Mining, NOSQL Systems

UNIT IV – Applications of Big Data (9 Hrs)

4.1 Big Data in Education - Big Data in Business and Finance
4.2 Big Data in Healthcare - Big Data in Digital Libraries and Information Systems
4.3 Social Media Analytics

Extra Reading / Keywords: Social Analytics, Business Analytics, Social Analytics

UNIT V – Challenges and Ethical Issues (9 Hrs)

5.1 Data Privacy and Security Issues - Ethical Considerations in Big Data

5.2 Governance and Regulatory Aspects - Data Quality Challenges

5.3 Future Trends in Big Data Analytics

Extra Reading/Keyword: Data Governance, Privacy & Ethics, Emerging Trends

PRESCRIBED TEXT BOOKS

1. Big Data and Analytics, Seema Acharya & Subhashini Chellappan, Wiley India Pvt. Ltd., New Delhi, 2015.
   UNIT I – Chapter 1: 1.1 – 1.6, Chapter 2: 2.1 – 2.4
   UNIT III – Chapter 5: 5.1 – 5.5, Chapter 6: 6.1 – 6.4
   UNIT IV – Chapter 8: 8.1 – 8.6, Chapter 9: 9.1 – 9.4
   UNIT V – Chapter 10: 10.1 – 10.5, Chapter 11: 11.1 – 11.4
2. Hadoop: The Definitive Guide, Tom White, 4th Edition, O'Reilly Media, 2015.
   UNIT II – Chapter 1: 1.1 – 1.5, Chapter 2: 2.1 – 2.7, Chapter 6: 6.1 – 6.6

SUGGESTED READINGS

1. Judith Hurwitz, Alan Nugent, Fern Halper & Marcia Kaufman**,** *Big Data Management for Dummies,* 2nd Edition, Wiley, 2016**.**
2. Kristina Chodorow**,** *MongoDB: The Definitive Guide*, 3rd Edition, O'Reilly Media, 2019**.**
3. Lars George**,** *HBase: The Definitive Guide,* O'Reilly Media, 2011**.**

WEB REFERENCES

1. https://hadoop.apache.org
2. https://www.mongodb.com

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO1	Explain the evolution and characteristics of big data	**K1**
CO2	Describe hadoop ecosystem and distributed storage architecture	**K2**
CO3	Apply mapreduce and hbase concepts for data processing	**K3**
CO4	Analyze nosql databases such as mongodb and cassandra	**K4**
CO5	Develop querying and analytics solutions using hive and pig	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	L	L	M	M	L	L	M
CO2	H	H	M	M	H	M	M	M	M
CO3	H	H	H	H	H	M	M	M	M
CO4	H	H	H	H	H	H	M	H	M
CO5	H	H	H	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	H	M
CO3	H	H	H
CO4	H	H	H
CO5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**NON-MAJOR ELECTIVE 2: GENERATIVE AI – LAB**
Course Code	**P25DS3SEP02**
Course Type	**Practical**
Semester	**III**
Hours / Week	**3**
Total Hours	**45**
Credits	**2**
Marks	**100**

CONSPECTUS

To create impactful digital content using AI tools like D-ID, ChatGPT, 10Web.io, and Canva for communication, design, and web development.

COURSE OBJECTIVES

1. To develop AI-enhanced video avatars and tutorials using D-ID for impactful digital communication.
2. To leverage ChatGPT for code generation, academic writing, and personalized assessment creation.
3. To construct and publish responsive static websites and interactive forms using 10Web.io.
4. To design and customize professional digital assets such as posters and resumes using Canva.
5. To integrate creative and AI-driven tools for building user-centric web content and digital portfolios.

EXERCISES

1. Introduction to Generative AI platforms – Interface and capabilities.
2. Prompt Engineering – Zero-shot, Few-shot, Chain-of-thought prompting.
3. Text Generation – Article writing, summarization, report drafting.
4. Image Generation using AI tools – Text-to-image models.
5. To Create a personalized talking avatar video
6. To Design an AI-powered video tutorial
7. To Develop a digital storytelling video
8. Create and deploy a personal static website
9. Build a professional resume as a live web page
10. Build a Simple Contact Form
11. Design a Poster for an Event
12. Create a Resume Template

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO1	Identify generative AI tools and their functionalities	**K1**
CO2	Demonstrate prompt engineering techniques	**K2**
CO3	Apply generative AI for text, code and image generation	**K3**
CO4	Analyze AI outputs for bias, ethics and performance	**K4**
CO5	Develop simple applications using generative AI tools	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	M	L	L	L	M	M	L	L	M
CO2	M	M	M	M	H	M	M	M	H
CO3	M	M	H	H	H	M	M	M	H
CO4	M	H	H	H	H	M	M	H	H
CO5	H	H	H	H	H	H	H	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	M	L	M
CO2	H	M	H
CO3	H	H	H
CO4	H	H	H
CO5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 14: ADVANCED WEB TECHNOLOGY WITH DJANGO**
Course Code	**P25DS4CCT14**
Course Type	**Theory**
Semester	**IV**
Hours / Week	**4**
Total Hours	**60**
Credits	**4**
Marks	**100**

CONSPECTUS

To understand the fundamentals of Django web development, including project structure, models, views, templates, forms, and user authentication.

COURSE OBJECTIVES

1. To recall and describe Django forms, file handling, and database integration concepts.
2. To explain Django request handlers and the integration of CSS and JavaScript within web applications.
3. To apply routing and view development using the Django framework to build dynamic web applications.
4. To analyze the process of web application development and manipulate Django models and objects effectively.
5. To design and demonstrate secure web applications using appropriate testing and security models in Django.

UNIT I - Django Overview **12 Hrs**

1.1 Introduction to Django Architecture
1.2 Installing Python and Setting Up the Development Environment
1.3 Django Project Creation and Execution

Extra Reading /Keywords: *Django – Admin Interface*

UNIT II - Django Application **12 Hrs**

2.1 Django Project Structure - Settings - Applications
2.2 Creating the Pages App - App Structure - Views - URL Configuration
2.3 Page Model - Django Admin - Admin Site Usage

Extra Reading /Keywords: *Django – Apps Life Cycle*

UNIT III - Django Templates **12 Hrs**

3.1 Template Settings - Site Template - Static Files - Pages Template
3.2 Updating and Rewriting Views - Modifying Page URLs - Testing the View
3.3 Modifying and Improving Templates - Navigation - Handling 404 Page Not Found

Extra Reading /Keywords: *Django extends and Django filters*

UNIT IV - Creating A Contact Form **12 Hrs**

4.1 Contact Form - URL Configuration - Navigation - Form Template - Form View - Email Integration
4.2 User Management - Users in Admin and Front End - Registration View

4.3 Authentication Templates - Login - Register - Success Page - Base Template Modification - URLconfigs - Testing and User Access Restriction

Extra Reading /Keywords: *Django contact form with Email backend*

UNIT V - Deploying A Django Website **12 Hrs**

5.1 Choosing a Host - Preparing the Site for Deployment - Deploying to PythonAnywhere

5.2 Adding a Database - Uploading Site Files - Installing Django and Web Application

5.3 Configuring the Web App - Running Management Commands - Static Files Linking - Home Page Setup - Production Mode Configuration

Extra Reading /Keywords: *Django Functions*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1–K5)
CO-1	identify the key concepts of Django architecture, project structure, and configuration.	K1
CO-2	explain the working of Django models, views, templates, and URL routing mechanisms.	K2
CO-3	analyze the development of dynamic web applications using forms, authentication, and database integration in Django.	K3
CO-4	apply user management, navigation control, and error handling techniques in Django web applications.	K4
CO-5	evaluate and deploy secure Django web applications in a production environment with appropriate configuration and optimization strategies.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

PRESCRIBED TEXT BOOK

1. Build a Website with Django 3: A Complete Introduction to Django 3", GNW IndependentPublishing, 2020.
   UNIT I – Chapter 3: 3.1 – 3.5, Chapter 4: 4.1, 4.3 – 4.8
   UNIT II – Chapter 6: 6.1 – 6.7, Chapter 7: 7.1 – 7.3
   UNIT III – Chapter 8: 8.1 – 8.4, Chapter 9: 9.1 – 9.4
   UNIT IV– Chapter 10: 10.1 - 10.6, Chapter 13: 13.1 – 13.5
   UNIT V – Chapter 14: 14.1 - 14.3

SUGGESTED REFERENCES

1. Melé, Antonio. Django 3 By Example: Build Powerful and Reliable Python WebApplications from Scratch, 3rd Edition. United Kingdom, Packt Publishing, 2020.
2. George, Nigel. "Build Your First Website with Python and Django", GNWIndependent Publishing, 2017.
3. Vincent, William S, "Django for Beginners: Build Websites with Python and Django",Amazon Digital Services LLC - KDP Print US, 2020.

WEB REFERENCES

1. Django Official Documentation
2. MDN Web Docs – Django Tutorial
3. PythonAnywhere Documentation (Deploying Django Applications)

MAPPING

PO – CO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	L	L	M	L	L	L	L
CO2	H	H	M	M	H	L	L	L	M
CO3	M	H	H	H	H	M	L	L	M
CO4	M	H	H	H	M	H	M	M	H
CO5	H	H	H	M	H	H	M	M	H

PSO – CO MAPPING

CO / PSO	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	H	M
CO3	M	H	M
CO4	M	M	H
CO5	H	H	H

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 15: DATA VISUALIZATION TOOLS - LAB**
Course Code	**P25DS4CCP15**
Course Type	**Practical**
Semester	**IV**
Hours/Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

This course provides hands-on training in web development using HTML, CSS, JavaScript, jQuery, Node.js, and Angular. It focuses on building dynamic, interactive applications with skills in DOM manipulation, validation, and component-based design.

COURSE OBJECTIVES

1. To understand the fundamental concepts of data visualization and business intelligence.
2. To explain the role of univariate, bivariate, time-series, and geospatial visualizations in decision-making
3. To apply Power Query for data cleaning, transformation, and preparation.
4. To analyze relationships between sales, profit, and market share using scatter plots, heatmaps and forecasting tools.
5. To evaluate business insights from interactive dashboards and recommend data- driven strategies.

EXERCISES

1. Chart preparation using excel sheet
2. Data analysis using google sheet
3. Creating dashboard and story
4. Map creation
5. Union and intersection
6. Importing a table in power bi
7. Chart view in power bi
8. Map creation in power bi
9. Chart preparation using pdf file
10. Create dashboard and report using power bi
11. Perform Data Cleaning and Transformation using Power Query in Power BI
12. Create Interactive Visualizations using Slicers and Filters in Power BI

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	identify fundamental concepts of data visualization and business intelligence tools.	K1
CO-2	explain different types of visualizations (univariate, bivariate, time-series, geospatial) and their role in decision-making.	K2
CO-3	apply power query techniques for data cleaning, transformation, and preparation in tableau and power bi.	K3
CO-4	analyze business data using interactive dashboards, kpis, and advanced visualization features.	K4
CO-5	evaluate data-driven insights and present findings effectively through storytelling dashboards and mini projects.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	L	H	M	H	H	M	M	M
CO2	H	M	H	H	M	M	M	H	H
CO3	H	H	M	H	L	M	L	M	H
CO4	M	M	H	H	M	H	M	H	H
CO5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	M
CO2	M	H	M
CO3	L	M	H
CO4	M	L	H
CO5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**CORE COURSE 16: ADVANCED WEB TECHNOLOGIES WITH DJANGO - LAB**
Course Code	**P25DS4CCP16**
Course Type	**Practical**
Semester	**IV**
Hours/Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To gain practical skills in advanced web development using Django, including project setup, templates, forms, models, REST APIs, and web scraping. Learners will be equipped to design, secure, and deploy dynamic, data-driven web applications.

COURSE OBJECTIVES

1. To understand and set up the Django development environment.
2. To develop and manage Django-based web applications with effective URL routing
3. To design and implement dynamic templates and customized forms.
4. To utilize Scrapy for web scraping in Django applications.
5. To secure, test, and deploy advanced Django-based web applications with RESTful APIs.

EXERCISES

1. Setting Up Django Environment
2. Creating Django Projects
3. Building URL Handlers
4. Working with Django Views
5. Building Django Templates
6. Working with Django Models and Import Data
7. Django Forms
8. Advanced Django Forms
9. Work with styling and customizing of Form Appearance
10. Building a REST API
11. Unit Testing and Securing Django APIs
12. Web Scrapping using ScraPy

COURSE OUTCOMES

The learners will be able to

CO No.	Course Outcomes	Cognitive Level (K1- K5)
CO-1	identify the fundamental concepts of advanced web technologies and the Django framework for web application development.	K1
CO-2	explain the architecture, components, and workflow of Django, including models, views, templates, and URLs	K2
CO-3	apply Django's features such as forms, and authentication to develop dynamic and secure web applications.	K3
CO-4	analyze the integration of front-end technologies with django for creating responsive and interactive user interfaces.	K4
CO-5	evaluate and deploy full-stack Django-based web solutions for real-time applications across various domains.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	L	H	M	H	H	M	M	M
CO2	H	M	H	H	M	M	M	H	H
CO3	H	H	M	H	L	M	L	M	H
CO4	M	M	H	H	M	H	M	H	H
CO5	M	H	M	M	H	H	M	H	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	M
CO2	M	H	M
CO3	L	M	H
CO4	M	L	H
CO5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	**ELECTIVE COURSE 6 (DISCIPLINE SPECIFIC): ADVANCED COMPUTING TECHNOLOGIES**
Course Code	**P25DS4ECT09**
Course Type	**Theory**
Semester	**IV**
Hours/Week	**4**
Total Hours	**60**
Credits	**3**
Marks	**100**

CONSPECTUS

To impart the basic concepts of Cloud Computing and understand the Technologies with a wide knowledge of the Virtualization concepts, Industries using Cloud Platforms and the major cloud applications.

COURSE OBJECTIVES

1. To remember the fundamental concepts, models, architectures, and deployment approaches of Cloud and Edge Computing, including their goals, benefits, and challenges.
2. To understand the core enabling technologies such as virtualization, containerization, networking, and orchestration that support scalable and secure Cloud–Edge environments.
3. To apply various Cloud platforms (AWS, Azure) and Edge middleware frameworks to deploy and manage real-time applications across diverse infrastructures.
4. To analyze the data analytics and machine learning capabilities within Cloud and Edge systems, emphasizing real-time processing, simulation tools, and interoperability.
5. To evaluate the security, privacy, and sustainability aspects of data storage and analytics in Cloud–Edge use cases, particularly in healthcare and Industrial IoT applications.

UNIT I - Understanding Cloud Computing (12 Hrs)

1.1 Origins and Influences - Basic Concepts and Terminology - Goals and Benefits - Risks and Challenges.

1.2 Fundamental concepts and models: Roles and Boundaries – Cloud Characteristics

1.3 Cloud Delivery Models - Cloud Deployment Models.

Extra Reading / Keywords: *Real time applications.*

UNIT II - Cloud-Enabling Technology (12 Hrs)

2.1 Networks and Internet Architecture – Data Center Technology – Modern Virtualization Technology- Multitenant Technology – Service Technology and Service APIs.

2.2 Understanding containerization: Origins and Influences – Fundamental Virtualization and Containerization

2.3 Understanding Containers – Understanding Container Images – Multi-container types.

Extra Reading / Keywords: *Containers Applications*

UNIT III – Amazon Services (12 Hrs)

3.1 Amazon ec2 and computer services: Amazon Global Cloud infrastructure – Building our first EC2 instances in the Amazon cloud – ELB and ASG – AWS compute from EC2 to containers to serverless.

3.2 Amazon cloud storage services: Understanding EBS, EFS & S3 – Understanding Snowball and Snowmobile – Accessing S3 from EC2 instances

3.3 Amazon data analytics services: Understanding the AWS big data pipeline – AWS Glue– Amazon Athena –Amazon – Quicksight – Amazon EMR

Extra Reading (Keyword): *Windows Azure platform appliance, Microsoft AZURE*

UNIT IV – Edge Computing **(12 Hrs)**

4.1 Edge computing and its essentials: Introduction - Edge Computing Architecture - Edge Devices - Edge Server Cluster - Cloud Server

4.2 Background essentials: IoT Devices - Mobile Phone-Based Sensors - Medical Sensors - Neural Sensors - Environmental and Chemical Sensors - Radio Frequency Identification – Actuators- Networking Architecture - Network Management and Control - Orchestration - Edge Computing State-of-the-Art Interfaces and Devices

4.3 Middleware**:** Hydra – Aura – TinyDB – Fiware – Application Interfaces - Edge Computing Simulators – PureEdgeSim – IoTSim-Edge – iFogSim - EdgeCloudSim

4.4 Edge analytics: Phases of Data Analytics - Types of Data Analytics - Edge Data Analytics - Potential of Edge Analytics - Architecture of Edge Analytics - Machine Learning for Edge Devices

Extra Reading / Keywords: *Edge Deployment Models, Edge-to-Cloud Integration*

UNIT V – Edge Case Studies and Use Cases **(12 Hrs)**

5.1 Edge data storage security: Data Security - Data Confidentiality – Encryption – Authentication Privacy-Preserving Schemes

5.2 Edge computing use cases and case studies: Use Cases - Edge Computing High-Potential Use Cases - Realization of Edge Computing in Healthcare Ensuring Storage Security - Devices and Setup

5.3 Case studies: Case Study I: Pulse Oximeter to Detect ARDS in Edge Server - Case Study II: Blood Pressure Monitor to Predict Hypotension in Edge Server - Case Study III: Body Composition Scale to Detect Heat Index in Edge Server

5.4 Use cases: Edge Computing/Analytics in Industrial IOT

Extra Reading / Keywords: *Edge AI in Medical Diagnostics, Edge Server Deployment in Hospitals*

Note: Texts given in the Extra Reading / Keywords must be assessed only through assignments and seminars.

PRESCRIBED TEXT BOOKS

1. Thomas Erl, Thomas Erl, Eric Barcelo Monroy, “Cloud Computing: Concepts, Technology, Security and Architecture”, Pearson Education, U.S.A., 2023.

UNIT I: Chapters 3 & 4

UNIT II: Chapters 5 & 6

2. Dr. Logan Song “The Self-Taught Cloud Computing Engineer”, Packt Publishing Ltd, UK, 2023.

UNIT III: Chapter 1, 2 & 5

3. R K. Anitha Kumari, G. Sudha Sadasivam, D. Dharani, M. Niranjanamurthy, “ Edge computing : fundamentals, advances and applications”, CRC Press, U.S.A 2022.

UNIT IV: Chapter 2 & 3

UNIT V: Chapter 4 & 6

SUGGEST READINGS

1. Michael Miller, “ Cloud Computing Web Based Applications That Change The WayYouWork And Collaborate Online”, Pearson Education, 2009.
2. Kris Jamsa, “Cloud Computing”, Jones and Bartlett Learning, 2013.
3. Perry Lea, “Edge Computing Simplified”, O’Reilly Media, 1st Edition, 2024

WEB REFERENCE

1. https://www.ibm.com/topics/cloud-computing
2. https://cloud.google.com/learn/what-is-cloud-computing
3. https://www.ibm.com/topics/edge-computing
4. https://aws.amazon.com/what-is/edge-computing/

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	identify the key concepts of cloud computing & edge computing.	K1
CO-2	explain the fundamental enabling technologies of cloud computing & edge computing.	K2
CO-3	analyze the creation, configuration, and deployment of compute instances across cloud and edge platforms.	K3
CO-4	apply various security mechanisms, including encryption, hashing, authentication, and digital signatures, to ensure data protection and secure communication in cloud–edge environments.	K4
CO-5	evaluate the energy efficiency and performance of diverse green cloud and edge computing architectures, and recommend strategies for enhancing sustainability and resource optimization.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

MAPPING

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	M	H	M	L	M	M	L	M
CO2	H	M	H	H	M	M	L	M	H
CO3	M	H	H	H	M	L	M	L	M
CO4	M	M	H	H	M	H	M	H	H
CO5	H	M	H	M	M	H	H	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	L
CO2	H	H	M
CO3	M	H	M
CO4	M	L	H
CO5	H	H	M

(For candidates admitted in the academic year 2025-26)

Course Title	ELECTIVE COURSE 6 (DISCIPLINE SPECIFIC): DATA ENGINEERING
CourseCode	P25DS4ECT10
Course Type	Theory
Semester	IV
Hours/Week	4
Total Hours	60
Credits	3
Marks	100

CONSPECTUS

To provide students with a strong foundation in data engineering concepts, architectures, and big data ecosystems for building scalable data systems.

COURSE OBJECTIVES

To enable the learners

1. To remember fundamental concepts, terminologies, and architectures of data engineering and big data ecosystems.
2. To understand the working principles of data ingestion, storage systems, and processing frameworks.
3. To apply data pipelines, ETL processes, and big data processing techniques using modern tools and platforms.
4. To analyze data workflows, system performance, and data processing strategies to optimize efficiency and scalability.
5. To evaluate data engineering solutions, architectures, and pipeline designs for real-world applications.

UNIT I - Introduction To Data Engineering **12 Hrs**

1.1 Definition, Data Engineering Life Cycle, Evolution of Data Engineer, Data Engineering Versus Data Science, Data Engineering Skills and Activities,

1.2 Data Maturity, Data Maturity Model, Skills of a Data Engineer, Business Responsibilities, Technical Responsibilities, Data Engineers and Other Technical Roles.

Extra Reading / Keywords: Data Maturity Model, Data Engineer Roles & Responsibilities

UNIT II - Data Engineering Life Cycle **12 Hrs**

2.1. Data Life Cycle Versus Data Engineering Life Cycle, Generation: Source System, Storage, Ingestion, Transformation, Serving Data.

2.2. Major undercurrents across the Data Engineering Life Cycle: Security, Data Management, DataOps, Data Architecture, Orchestration, Software Engineering.

Extra Reading / Keywords: Data Engineering Pipeline, ETL / ELT Workflow

UNIT III - Designing Good Data Architecture **12 Hrs**

3.1. Enterprise Architecture, Data Architecture, Principles of Good Data Architecture, Major Architecture Concepts.

3.2. Data Generation in Source Systems: Sources of Data, Files and Unstructured Data, APIs, Application Databases (OLTP), OLAP, Change Data Capture, Logs, Database Logs, CRUD, Source System Practical Details.

Extra Reading / Keywords: Enterprise & Data Architecture, OLTP vs OLAP Systems

UNIT IV - Storage **12 Hrs**

4.1. Raw Ingredients of Data Storage, Data Storage Systems, Data Engineering Storage Abstractions, Data warehouse, Data Lake, Data Lakehouse.

4.2. Ingestion: Data Ingestion, Key Engineering considerations for the Ingestion Phase, Batch Ingestion Considerations, Message and Stream Ingestion Considerations, Ways to Ingest Data

Extra Reading / Keywords: *Data Warehouse – Data Lake – Lakehouse, Batch vs Stream Ingestion*

UNIT V - Queries, Modeling And Transformation **12 Hrs**

5.1. Queries, Life of a Query, Query Optimizer, Queries on Streaming Data, Data Modelling, Modeling Streaming Data, Transformations, Streaming Transformations and Processing.

5.2. Serving Data for Analytics, Machine Learning and Reverse ETL: General Considerations for serving Data, Business Analytics, Operational Analytics, Embedded Analytics, Ways to serve data for analytics and ML, Reverse ETL.

Extra Reading / Keywords: Query Optimization & Execution, Data Modeling & Transformations

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO 1	Recall the key concepts, terminologies, architectures, and lifecycle models of data engineering and big data ecosystems.	**K1**
CO 2	Explain the fundamental principles of data ingestion, storage systems, processing frameworks, and data pipeline architectures.	**K2**
CO 3	Analyze the design, configuration, and performance of batch and real-time data processing pipelines using distributed systems.	**K3**
CO 4	Apply appropriate tools and technologies such as SQL, NoSQL, Hadoop, Spark, and workflow orchestration frameworks to build scalable data engineering solutions.	**K4**
CO 5	Evaluate the efficiency, scalability, reliability, and data quality of data engineering architectures and recommend suitable optimization strategies for real-world applications.	**K5**

(K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate)

PRESCRIBED TEXT BOOK

1. Joe Reis, Matt Housley, Fundamentals of Data Engineering, O'Reilly Media, Inc., June 2022. ISBN: 9781098108304

Unit I : Chapter 1
Unit II : Chapter 2
Unit III : Chapter 3
Unit IV : Chapter 6, 7
Unit V : Chapter 8

SUGGEST READINGS

1. Paul Crickard, Data Engineering with Python, Packt Publishing, October 2020.
2. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, Wiley, 3rd Edition, 2013
3. James Densmore, Data Pipelines Pocket Reference: Moving and Processing Data for Analytics, O'Reilly Media, Ist Edition, 2021

WEB REFERENCES

1. https://www.geeksforgeeks.org/data-engineering/data-engineering-101/
2. https://learn.microsoft.com/en-us/fabric/data-engineering/?utm_source=chatgpt.com
3. https://www.datacamp.com/tutorial/category/data-engineering?utm_source=chatgpt.com

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO 1	H	M	H	M	L	M	M	L	M
CO 2	H	M	H	H	M	M	L	M	H
CO 3	M	H	H	H	M	L	M	L	M
CO 4	M	M	H	H	M	H	M	H	H
CO 5	H	M	H	M	M	H	H	M	M

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO 1	H	M	L
CO 2	H	H	M
CO 3	M	H	M
CO 4	M	L	H
CO 5	H	M	H

(For candidates admitted in the academic year 2025-26)

Course Title	SEC 3: PROFESSIONAL COMPETENCY SKILL ENHANCEMENT COURSE: FEDERATED LEARNING
Course Code	P25DS4SET03
Course Type	Theory
Semester	IV
Hours/Week	4
Total Hours	60
Credits	2
Marks	100

CONSPECTUS

To provide students ability to critically assess real-world applications of quantum computing and federated learning, by applying their benefits.

COURSE OBJECTIVES

1. To understand the fundamental concepts and motivation of Federated Learning, Distributed Machine Learning, and Transfer Learning.
2. To describe different architectures and categories of Federated Learning, including horizontal, vertical, and heterogeneous models.
3. To apply optimization and distributed training techniques to large-scale machine learning problems.
4. To analyze privacy-preserving methods, secure computation, and incentive mechanisms in real-world federated and distributed systems.
5. To evaluate practical applications of Federated Learning in vision, language, recommendation systems, and reinforcement learning.

UNIT I – Introduction to Federated Learning **12 Hr**

1.1 Motivation and Overview – Motivation for Federated Learning – Federated Learning as a Solution – Definition and Categories of Federated Learning

1.2 Developments and Ecosystem – Current Development – Research Issues – Open-Source Projects and Standardization Efforts

1.3 Privacy Background – Privacy-Preserving Machine Learning – Secure ML – Privacy Threats and Security Models

***Extra Reading / Keywords**: Cross-Device Federated Learning, Secure Multi-Party Computation, Data Privacy Laws*

UNIT 1I - Distributed Machine Learning **12 Hrs**

2.1 Introduction to DML- The Definition of DML - DML Platforms - Scalability- Motivated DML - Large- Scale Machine Learning - Scalability-Oriented DML Schemes

2.2 Privacy-Motivated DML - Privacy- Preserving Decision Trees - Privacy-Preserving Techniques - Privacy-Preserving DML Schemes

2.3 Privacy-Preserving Gradient Descent - Vanilla Federated Learning - Privacy-Preserving Methods

***Extra Reading / Keywords:** Data Sharding, Federated Data, Homomorphic Encryption, Real-Time Machine Learning*

UNIT III – Horizontal and Vertical Federated Learning **12 Hrs**

3.1 Horizontal Federated Learning – Definition and Architecture – Client-Server and Peer-to-Peer – FedAvg and Secured FedAvg Algorithms

3.2 Optimization and Efficiency – Federated Optimization – FedAvg Improvements – Communication Efficiency and Client Selection

3.3 Vertical Federated Learning – Definition and Architecture – Algorithms – Secure Linear Regression and Tree-Boosting

UNIT IV – Federated Transfer Learning and Incentives **12 Hrs**

4.1 Federated Transfer Learning – Heterogeneous Federated Learning – FTL Framework – Training and Prediction Process

4.2 Security in FTL – Homomorphic Encryption – Secret Sharing – Security Analysis

4.3 Incentive Mechanisms – Paying for Contributions – Profit Sharing and Reverse Auctions – Fairness-Aware Payoff Computation

UNIT V – Federated Learning for Applications and Reinforcement Learning **12 Hrs**

5.1 Applications in Vision, Language, and Recommendation – Federated CV – Federated NLP – Federated Recommendation Systems

5.2 Federated Reinforcement Learning Basics – Introduction to RL – Policy, Reward, Value Function – Environment Modeling

5.3 Distributed and Federated RL – RL Algorithms – Asynchronous and Synchronous Distributed RL – Federated RL Overview

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Identify the fundamental concepts, motivation, and categories of Federated Learning, Distributed Machine Learning, and Transfer Learning.	K1
CO-2	Describe the architectures and components of horizontal, vertical, and heterogeneous Federated Learning models.	K2
CO-3	Apply optimization, distributed training, and scalability techniques to solve large-scale machine learning problems.	K3
CO-4	Analyze privacy-preserving methods, secure computation, and incentive mechanisms in real-world federated and distributed systems.	K4
CO-5	Evaluate practical applications of Federated Learning in computer vision, natural language processing, recommendation systems, and reinforcement learning.	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

PRESCRIBED TEXT BOOK

1. Qiang Yang, Yang Liu, Yong Cheng, Yan Kang, Tianjian Chen, and Han Yu,"Federeted Learning" , Springer Nature Switzerland AG 2022

Unit 1: Chapter 2
Unit 2: Chapter 3
Unit 3:Chapter 4
Unit 4: Chapter 5
Unit 5 : Chapter 9

SUGGEST READINGS

1. Han Yu, Lixin Fan, Qiang Yang," Federated Learning", Springer Nature Switzerland AG 2020.
2. Heiko Ludwig, Nathalie Baracaldo," Federated Learning A Comprehensive Overview of Methods and Applications," Springer Nature Switzerland AG 2022.

WEB REFERENCE

1. https://towardsdatascience.com/federated-learning-a-step-by-step-implementation-in-tensorflow-aac568283399
2. https://www.javatpoint.com/federated-learning-in-machine-learning

MAPPING:

PO – CO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H	H	M	H	L	H	M	H	M
CO2	H	M	H	M	M	H	M	H	H
CO3	H	M	L	H	H	M	H	H	H
CO4	L	M	L	L	H	H	H	H	M
CO5	L	M	L	L	M	H	M	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	H
CO2	H	M	H
CO3	M	H	M
CO4	M	M	H
CO5	H	H	M

(For the candidates admitted from 2025 – 2026 onwards)

Course Title	SELF-STUDY COURSE: PROFESSIONAL ETHICS
Course Code	P24DS4SST01
Course Type	Theory
Semester	IV
Hours/Week	-
Total Hours	-
Credits	2
Marks	100

CONSPECTUS

To understand the concepts of computer ethics in work environment

COURSE OBJECTIVES

1. To understand the basic concepts of computer ethics and computer hacking
2. To identify to regulate the internet content, technology and safety
3. To apply the aspects of computer crime and intellectual property rights
4. To analyze the issues for accessing computer technologies.
5. To evaluate the ethical, legal, and social implications of emerging computer technologies.

UNIT I: Computer Ethics Introduction and Computer Hacking

1.1. A general Introduction – Computer ethics: an overview – Identifying an ethical issue – Ethics and law – Ethical theories - Professional Code of conduct

1.2. An ethical dilemma – A framework for ethical decision making - Computer hacking – Introduction – definition of hacking

1.3. Destructive programs – hacker ethics - Professional constraints – BCS code of conduct – To hack or not to hack? – Ethical positions on hacking.

Extra Reading /Keywords: *hacking, ethics*

UNIT II: Aspects of Computer Crime and Intellectual Property Rights

2.1 Aspects of computer crime - Introduction - What is computer crime – computer security measures – Professional duties and obligations

2.2 Intellectual Property Rights – The nature of Intellectual property – Intellectual Property – Patents, Trademarks, Trade Secrets, Software Issues, Copyright -

2.3 The extent and nature of software piracy – Ethical and professional issues – free software and open source code.

Extra Reading /Keywords: *Security, Copyrigh*

UNIT III: Regulating Internet Content, Technology and Safety

3.1 Introduction – In defence of freedom expression – censorship – laws upholding free speech– Free speech and the Internet

3.2 Ethical and professional issues - Internet technologies and privacy – Safety and risk

3.3 Assessment of safety and risk – risk benefit analysis – reducing risk.

Extra Reading /Keywords: *censorship, privacy.*

UNIT IV: Computer Technologies Accessibility Issues

4.1 Introduction – Principle of equal access – Obstacles to access for individuals – professional responsibility - Empowering computers in the workplace

4.2 Introduction – computers and employment – computers and the quality of work – computerized monitoring in the work place – telecommuting – social, legal and professional issues

4.3 Use of Software, Computers and Internet- based Tools - Liability for Software errors Documentation Authentication and Control

4.4 Software engineering code of ethics and practices – IEEE-CS – ACM Joint task force.

Extra Reading /Keywords: *Technological issues, professional responsibility.*

UNIT V: Software Development and Social Networking

5.1 Software Development – strategies for engineering quality standards – Quality management standards

5.2 Social Networking – Company owned social network web site – the use of social networks in the hiring process – Social Networking ethical issues

5.3 Cyber bullying – cyber stalking – Online virtual world – Crime in virtual world - digital rights management - Online defamation – Piracy – Fraud.

Extra Reading /Keywords: *Cybercrime, Cyber stalking*

Note: Texts given in the Extra reading /Key words must be tested only through Assignment and Seminars.

COURSE OUTCOMES

The learner will be able to

CO No.	Course Outcomes	Cognitive Level (K1-K5)
CO-1	Identify the need for ethical principles, values to tackle with various situations	K1
CO-2	Explain the code of ethics and standards of computer Professionals	K2
CO-3	Apply ethical values in the working environment	K3
CO-4	Analyze the professional responsibility and empowering access to information in the work place	K4
CO-5	Evaluate responsible attitude towards the use of computer as well as the technology able to envision the societal impact on the products/ projects they develop in their career	K5

(K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate)

PRESCRIBED TEXT BOOKS

1. Caroline Whitback," Ethics in Engineering Practice and Research ", Cambridge University Press, 2011.
2. George Reynolds, "Ethics in Information Technology", Cengage Learning, 2011.

SUGGEST READINGS

1. John Weckert and Douglas Adeney, Computer and Information Ethics, Greenwood Press,1997.
2. Penny Duquenoy, Simon Jones and Barry G Blundell, "Ethical , legal and professional issues in computing", Middlesex University Press, 2008.
3. Richard Spinello, "Case Studies in Information and Computer Ethics", Prentice Hall,1997.
4. Sara Baase, "A Gift of Fire: Social, Legal, and Ethical Issues for Computing and the Internet", 3rd Edition,Prentice Hall, 2008.

WEB REFERENCE

1. http://www.infosectoday.com/Articles/Intro_Computer_Ethics.html

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CO3	H	M	L	M	H	M	H	M	L
CO4	L	M	M	H	H	L	H	H	M
CO5	L	M	L	L	M	H	M	M	H

PSO – CO MAPPING

CO/PSO	PSO1	PSO2	PSO3
CO1	H	M	H
CO2	H	H	M
CO3	M	M	H
CO4	M	M	H
CO5	H	H	M