

SHIVAJI UNIVERSITY, KOLHAPUR - 416 004, MAHARASHTRA

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शिवाजी विद्यापीठ, कोल्हापुर - ४१६ ००४, महाराष्ट्र

दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दुरध्वनी ०२३१–२६०९०९३/९४



SU/BOS/Science/500

Date: 10/07/2023

To,

The Principal,	The Head/Co-ordinator/Director			
All Concerned Affiliated Colleges/Institutions	All Concerned Department (Science)			
Shivaji University, Kolhapur	Shivaji University, Kolhapur.			

Subject: Regarding syllabi of as per NEP-2020 under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of degree programme under the Faculty of Science and Technology.

1.	B.ScM.Sc. Part II Nanoscience and	7.	All Faculty Under Graduate Part II			
	Technology		Environmental Studies			
2.	M.C.A. Part I (New NEP -2020)	8.	P.G. Diploma in Data Science			
3.	B.C.A. Part II	9.	P.G. Diploma in Environment Protection			
			& Management			
4.	M.C.A. Part II	10.	P.G. Diploma in Industrial Safety, Health			
			& Environment			
5.	B.Sc. Part III Food Science	11.	Diploma in Industrial Safety, Health &			
			Environment			
6.	B.Sc. Part I Drug Chemistry	12.	All Faculty UG & PG Value Added Course			
			: Intellectual Property Rights			

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website <u>www.unishivaji.ac.in</u>)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Dy Registrar r. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section		
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section		
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)		
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education		

SHIVAJI UNIVERSITY, KOLHAPUR



NAAC "A++" Grade with CGPA 3.52

Choice Based Credit System with NEP-2020

Syllabus for

Post Graduate Diploma in

Data Science (PGDDS)

(Under Faculty of Science and Technology)

(Syllabus to be implemented from Academic year 2023-24)

Shivaji University, Kolhapur

Department of Computer Science

Post Graduate Diploma in Data Science(PGDDS)

(NEP-2020)

(Under faculty of Science and Technology)

1. Introduction

The Post Graduate Diploma in Data Science (PGDDS) aims to prepare the student for a career as a data scientist, in the corporate sector, industries, for entrepreneurship, public policy or even academia. While focusing on the core statistical, quantitative and computing skills required in these careers, this Data Science course also arms students with domain knowledge in allied verticals so they can add value as data scientists.

The PGDDS intends to provide broad exposure to key concepts and tools viz. Python, Machine Learning and Deep Learning as well as hands-on laboratory and project work in Data Science. With successful completion, students can start their career as a Data Analyst, Data Scientist, Data Engineer, Product Analyst, Machine Learning Engineer, Decision Scientist and so on.

Learning Goals:

Learning Goals for the PGDDS are:

- Students will develop relevant programming abilities.
- Students will demonstrate proficiency with statistical analysis of data.
- Students will develop the ability to build and assess data-based models.
- Students will execute statistical analyses with professional statistical software.
- Students will demonstrate skill in data management.
- Students will apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

2. Duration of the Course:

The Post Graduate Diploma in Data Science (PGDDS) will be one year programme.

Pattern of examination will be Annual.

Intake capacity: 40

Fees: 38214/-

3. Medium of Instruction: The medium of Instruction will be English only.

4. Admission Procedure

- 1. **Eligibility:** Bachelor's Degree with minimum 50% or equivalent passing marks.
- 2. Reservation of Seats As per rules of Government of Maharashtra.
- 3. Admission will be on first come first serve basis.

You are well-suited to pursue the Graduate Diploma in Data Science if:

- You have a strong quantitative undergraduate degree, such as in Statistics, Mathematics, Computing, Economics, the physical sciences, or engineering, to name a few
- You enjoy working with numbers to glean trends and patterns from them
- You want to pursue a rigorous Data Science programme, with applications in social, political, economic, legal, business and marketing fields.

5. Course Structure:

Lectures and Practical shall be conducted as per the scheme of lectures and practical indicated in the course structure. The program will be conducted in the morning session from 7.30 am to 11.30 am to suit the working professionals.

Teaching and Practical Scheme

- 1. Each contact session for teaching or practical shall be of 60 minutes each.
- 2. One Practical Batch shall be of 30 students.
- 3. Practical and project evaluation shall be conducted before the commencement of annual examination.

Project Work:

- 4. Project work may be done individually or in groups in case of bigger projects. However if project is done in groups, each student must be given a responsibility for a distinct module and care should be taken to see the progress of individual modules are independent of others.
- 5. Students should take guidance from assigned guide and prepare a Project Report on "Project Work".
- 6. The project report should be prepared in a format prescribed by the University, which also specifies the contents and methods of presentation. IEEE Computer Society templates are recommended in this regard.
- 7. The external viva shall be conducted by a panel of minimum two examiners out of which one will be external and other will be internal examiner.

OR

The student shall be allowed to formulate a proposal for startup and the same shall be rated equivalent to project. A detailed problem statement showing innovation along with marketability, business plan and cash flow shall be part of the evaluation criteria.

8. Assessment:

- 1) For each theory paper, 50% marks will be based on CIE and 50% marks for university Examination.
- 2) The project will be evaluated by the university appointed examiners both internal as well as external.
 - 1. The final practical examination will be conducted by the university appointed examiners both internal as well as external at the end of year for each laboratory course and marks will be submitted to the university by the panel. The pattern of final Practical Examination will be as follows;

1	Programming and Execution of Program	60 Marks
2	Viva-voce	20 Marks
3	Journal(Internal)	20 Marks
4	Total	100 Marks

- 2. The final Examinations shall be conducted at the end of the year.
- 3. Nature of question paper:

Nature of question paper is as follows for University end year examination

a. Theory Examination:

- 1. There will be seven (7) questions of 10 Marks and out of which four to be attempted from question no 2 to7.
- 2. Question No.1 is compulsory and is of multiple choice questions. There will be 5 multiple choice question each carries 2 marks

b. Practical Examination:

- 1. Duration of Practical Examination: 3 Hrs
- 2. Nature of Question paper: There will be three questions out of which any two questions to be attempted and each question carries 30 Marks.

9. Standard of Passing:

Internal as well as external examination will be held at the end of the year. The candidate must score 40% marks in each head of internal as

well as external Examination

Post Graduate Diploma in Data Science (PGDDS)

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To be implemented from the academic year 2023-24

Sr. No	Course code	Course title	Theory contact hours per week	Practical hours per week	Credits	University exam	Internal continuous assessment	Total
1	DDS-1	Foundations Of Data Science	2	-	4	50	50	100
2	DDS-2	Python for Data Science	2	-	4	50	50	100
3	DDS-3	AI and Machine Learning	2	-	4	50	50	100
4	DDS-4	Deep Learning	2	-	4	50	50	100
5	DDS-5	Lab I(Based on DDS-2)	-	5	4	80	20	100
6	DDS-6	Lab II(Based on DDS-3 and DDS-4)	-	5	4	80	20	100
7	DDS-7	Project	-	2	4	80	20	100
		Total	8	12	28	440	260	700

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DDS-1: Foundations of Data Science

Course Outcome:

- **1.** Organize, manage, and present data. Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- **2.** Analyze statistical data using measures of central tendency, and dispersion. Perform data analysis using Excel.
- **3.** Build and evaluate linear regression models, starting from simple linear regression and extending to multiple linear regressions.
- 4. Calculate and interpret a simple linear regression model in linear regression mode.
- **5.** Integrate machine learning libraries, and mathematical and statistical tools with modern technologies such as Hadoop, MapReduce, Hive, Weka, and Tableau for data analysis and visualization.

Unit 1

Data Science Fundamentals, Introduction to Data Science: Overview and components ,Model Building Process: Steps involved in building data science models, Data Types and Measures: Understanding different data types and their measures, Random Variables: Introduction and applications with exercises, Sampling Techniques: Overview of sampling methods and their types, Discussions on Data Ethics, Privacy, and Governance

Unit 2

Basics of Statistics ,Measures of Central Tendency: Mean, Median, and Mode,Measures of Dispersion: Variance, Standard Deviation, and Range,Skewness and Kurtosis: Understanding measures of data distribution, Graphical Representations: Various graphical techniques for data analysis,Probability Concepts: Introduction to probability, Binomial, Poisson, and Normal distributions,Central Limit Theorem: Understanding sampling variations, Hypothesis Testing: Basic concepts,Confidence Interval: Computation and analysis ,Parametric and Nonparametric Tests: Overview of different types of statistical tests ,Practical Exercises with Excel / R / Python for data analysis

(15 hrs)

(15 hrs)

(15 hrs)

Regression Analysis and Time Series Analysis, Correlation: Concept and analysis of the correlation between variables, Regression Analysis: Ordinary Least Squares regression model, Prerequisites to regression, Model Assumptions, Model evaluation, and improvement techniques, Interpretation of Coefficients ,Imputation and Deletion: Listwise, pairwise deletion, Imputation techniques: Mean, Median, Mode, Regression Imputation, Hot Deck, KNN imputation, Time Series Analysis: Introduction, Data visualization, Exploration, and modelling of time series data, Practical exercises on regression analysis and time series modelling, Real-world datasets and case studies for analysis

Unit 4

Data Analysis Tools, Data Analysis with Excel and R: Using Excel and R for data analysis, Overview of Tools: Introduction to SQL, Hadoop, Hive, Weka, Tableau, and big data analysis, Hands-on practice sessions with Excel or R

References

- 1. James, G., Witten, D., Hastie, T., & amp; Tibshirani, R. (2013). An introduction to statistical learning(Vol. 112, p. 18). New York: springer.
- 2. Montgomery, D. C., Peck, E. A., & amp; Vining, G. G. (2012). Introduction to linear regression analysis (Vol. 821). John Wiley & amp; Sons.
- 3. Grus, J. (2019). Data science from scratch: first principles with python. O'Reilly Media.
- 4. Wickham, H., Çetinkaya-Rundel, M., & amp; Grolemund, G. (2023). R for data science. Reilly Media, Inc.".
- 5. Peng, R. D. (2016). R programming for data science (pp. 86-181). Victoria, BC, Canada: Leanpub.
- 6. Cowpertwait, P. S., & amp; Metcalfe, A. V. (2009). Introductory time series with R. Springer.
- 7. Linoff, G. S. (2015). Data analysis using SQL and Excel. John Wiley & amp; Sons.

Unit 3

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DDS-2: Python for Data Science

Course Outcome:

After completion of this course student will able to:

- 1. Learn python fundamentals, python data structures, and working with data in python
- 2. Handle key Python functions, objects, and classes
- 3. Implement OOPs concepts in your programming
- 4. Create an application with the support of graphics in Python

Unit 1

Introduction to Python, Installing Python and IDEs, Running Python programs, Variables and data types, Basic input and output, Operators and expressions, Conditional statements, Loops, Functions and parameters, Returning values from functions, Recursion, Exception handling

Unit 1I

Storing and Accessing Data in Lists, Modifying Lists, Operations on Lists, Slicing Lists, Aliasing, List Methods, Working with a List of Lists, Processing Lists Using Indices, Storing Data Using Sets, Storing Data Using Tuples, Storing Data Using Dictionaries, Introduction to OOP, Classes and objects, Inheritance and polymorphism, Encapsulation and data hiding, Overloading and overriding

Unit III

Importing modules and libraries, commonly used Python libraries (e.g., math, random, datetime), Introduction to third-party libraries (e.g., NumPy, Pandas), Reading and writing files, CSV and JSON data processing, Data manipulation and analysis, Data visualization

Unit 1V

Introduction to web scraping, Using BeautifulSoup for web scraping, Working with APIs and

(15 hrs)

(15 hrs)

(15 hrs)

retrieving data, JSON and XML parsing, Introduction to GUI (Graphical User Interface) programming, Introduction to Tkinter, Creating windows and basic widgets, Handling events and user input, Designing interactive GUI applications

References:

- 1. Practical Programming: An introduction to Computer Science Using Python, second edition, Paul Gries, JenniferCampbell, Jason Montojo, The Pragmatic Book shelf.
- 2. Python for Informatics:Exploring Information,Charles Severance
- 3. Learning Python, Fourth Edition ,MarkLutz,O'Reillypublication
- 4. Introduction to Python for Computational Science and Engineering(Abeginner'sguide),HansFangohr
- 5. JohnVGuttag."IntroductiontoComputationandProgrammingUsingPython",Prentic Hall of India
- 6. R.NageswaraRao,"Core Python Programming", Dreamtech

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DDS-3 AI and Machine Learning

Course Outcome

- 1. Provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence.
- 2. Ability to select and implement machine learning techniques and AI computing environment that are suitable for the applications under consideration
- 3. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
- 4. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques
- 5. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

Unit-I

Introduction to Artificial Intelligence and Machine learning, Essential concepts in Artificial Intelligence and Machine learning. Machine learning basics: Key terminology, Key tasks of machine learning, choosing the right algorithm, Steps in developing a machine learning application.

Unit-II

Supervised Learning The k-Nearest Neighbours classification algorithm, Parsing and importing data from a text file, Support Vector Machine, Types and working of SVM, Decision tree, Tree construction, plotting trees in Python, Testing and storing the classifier.

Unit-III

Naïve Bayesian decision theory, Conditional probability, classifying with conditional probabilities, Document classification with naïve Bayes, classifying text with python, Case study: classifying spam email with naïve Bayes. Unsupervised learning: Clustering, Grouping unlabelled data using K-Means clustering, K-means algorithm.

Unit-IV

Recommender System: Introduction, Understanding Recommendation Systems, Content Based Filtering, User Based Collaborative Filtering, Item Based Collaborative Filtering,Methods and tricks of the trade, Issues in Recommendation Systems, Recommender System in Python.

(15 hrs)

(15 hrs)

(15 hrs)

References:

1. Machine Learning and Artificial Intelligence, Ameet V. Joshi, Springer, Cham

2. Machine Learning in Action, Peter Harrington, April 2012, Manning publications.

https://livebook.manning.com/book/machine-learning-in-action/about-this-book/

3. Artificial Intelligence and Machine Learning Fundamentals by Zsolt Nagy

4. Data Mining Concepts and Techniques, Jiawei Han and Micheline Kamber, Else

Shivaji University, Kolhapur Post Graduate Diploma in Data Science (PGDDS) (NEP-2020) (Under Faculty of Science & Technology) DDS-4 Deep Learning

Course Outcome

After completion of this course student will able to,

- 1. Understand neural network structure and working
- 2. Understand deep learning networks
- 3 .Understand Keras, Tensor Flow, Theano libraries.
- 4. Understand convolutional neural network

Unit-I

Introduction to Neural Networks - Inspiration from the Human Brain Introduction to Perceptron ,Binary classification using Perceptron Perceptrons - Training ,Multiclass Classification using Perceptrons ,Working of a Neuron ,Inputs and Outputs of a Neural Network ,Assumptions made to Simplify Neural Networks ,Parameters and Hyper parameters of Neural Networks Activation Function, Introduction to neural network: Shallow neural network, Deep neural network.

Unit-II

Introduction to deep learning: Definition, Need, Relationship between Artificial intelligence, machine learning, and deep learning, Deep learning Process. Types of Deep Learning Networks: Feed-forward neural networks, Recurrent neural networks (RNNs), Convolutional neural networks (CNN), Deep learning applications ,Advantages and Limitations of deep learning. Deep learning Libraries /Frameworks: PyTorch, Keras, Theano.

Unit-III

Introduction to Keras: Tensor Flow, Theano, CNTK, Installation of Keras library in Anaconda, Setting up a deep-learning workstation Jupyter notebook: the preferred way to run deep-learning Experiments, Running deep-learning jobs in the cloud: pros and cons. Deep Learning with Keras: Setting up Project, Starting Jupyter, Importing Libraries, and Creating Deep Learning Model

Unit-IV

Introduction to convents: Foundations of Convolutional Neural Networks, Training a convnet from scratch on a small dataset, using a pretrained convent, visualizing what convnets learn. Deep Convolutional Models: Case Studies

References:

1. Deep Learning with Python, FRANÇOIS CHOLLET

(15 hrs)

(15 hrs)

(15 hrs)

- 2. Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola
- 3. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville
- 4. Neural Networks and Deep Learning, Michael Nielsen's

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DDS-5 Lab I (Based on DDS-2)

Practical assignments based on Python for Data Science (DDS-2)

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DDS-6 Lab II (Based on DDS-3 and DDS-4)

Practical assignments based on AI and Machine Learning & Deep Learning (DDS-3 and DDS-4)

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DDS-7 Project

Project work should be carried out with application of data science over the period of 8 months.