

**MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB**  
(Formerly West Bengal University of Technology)

**Syllabus for B. Sc. in Data Science**  
(Effective for Academic session 2019-20)

**5<sup>th</sup> SEMESTER**

**BSCDA-501: ADVANCED PROGRAMMING IN PYTHON**

**Objectives**

To enable the students to:

learn how to analyze data in Python using multi-dimensional arrays in numpy, manipulate DataFrames in pandas, use SciPy library of mathematical routines,

<b>Units</b>	<b>Course Content</b>
1	<b>Python Basic:</b> Python fundamental, working with data
2	<b>Importing Dataset</b> Domain, Dataset, Package for Data Science, Importing/Exporting Data, Insight from Dataset
3	<b>Cleaning and Preparing the Data</b> Identify and Handle Missing Values, Data Formatting, Normalisation, Binning
4	<b>Summarising the Data Frame</b> Descriptive Statistics, Grouping, ANOVA, Correlation
5	<b>Model Development</b> Linear Regression, Prediction and Decision making
6	<b>Data Visualization</b> Introduction to Matplotlib, Basic plotting, Charts

**References**

1. Python: 3 Manuscripts in 1 book: - Python Programming For Beginners - Python Programming For Intermediates  
- Python Programming for Advanced, By Maurice J.Thompson
2. Advanced Machine Learning with Python, By John Hearty

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**BSCDA-502: DATA SECURITY**

**Objectives**

To enable the students to:

- to train students in the organizing and the technical realization and security of data and computers

<b>Units</b>	<b>Course Content</b>
1	Information system security and protection objectives. The development of the Internet and the role of the intranet and extranet. Control at the level of management: data control, data administration, security control, control at the management level. Software control. Access Control: cryptography, identification numbers, digital signatures, security and credit card business. Input control, communication control, control of data processing, database control, output data control. Legal aspects of the security of information systems. Information systems security planning: security management information system, the reconstruction plan information system, ISO / IEC 17799: 2000. The insurance. Network security threats: spyware, search, denial of services, misrepresentation, playback and session hijacking, redirections, viruses, Trojan horses, and worms. Defining a security policy. Protecting the network and operating system services. Protecting DNS, NIS, Proxy, e-mail, WWW, FTP, NFS. Firewalls, NAT. Security services and procedures: one-time passwords, token cards / soft tokens, TACACS +, RADIUS, KERBEROS, VPN, IKE / IPSec. Secure data storage. Monitoring the performance of the system. Intrusion detection systems. Reestablishment of network systems.

**References**

1. Sharing Big Data Safely: Managing Data Security - Managing Data Security (English, Paperback, Ellen Friedman Ted Dunning).

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**BSCDA-503: TIME SERIES**

**Objectives**

To enable the students to:

- have deeper knowledge of statistical theory and methods particularly common problems in economical social sciences especially economics.
- be able to estimate models for time-series data.
- be able to interpret the results of an implemented statistical analysis
- be aware of limitations and possible sources of errors in the analysis
- have ability to present results in oral and written form

<b>Units</b>	<b>Course Content</b>
1	Overview of forecasting. Models for time series: Time-dependent seasonal components. Autoregressive (AR), moving average (MA) and mixed ARMA-modeller. The Random Walk Model. Box-Jenkins methodology. Forecasts with ARIMA and VAR models. Dynamic models with time-shifted explanatory variables. The Koyck transformation . Partial adjustment and adaptive expectation models. Granger's causality tests. Stationarity, unit roots and cointegration. Modelling of volatility: ARCH - and the GARCH-models.

**References**

1. Time Series Analysis, By James D.Hamilton
2. Time Series, By Peter J Brockwell and Richard A Davies

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**BSCDA-504: WEB INTELLIGENCE**

**Objectives**

To enable the students to:

- Get introduced to topics of web intelligence.
- Study models of information retrieval, semantic webs, search engines, and web mining.
- Learn applying data mining tools to develop projects in web mining and information retrieval.

<b>Units</b>	<b>Course Content</b>
1	<p>Introduction to Web Intelligence</p> <ul style="list-style-type: none"><li>What is Web Intelligence?</li><li>Benefits of Intelligent Web</li><li>Ingredients of Web Intelligence</li><li>Topics of Web Intelligence</li><li>Related Technologies</li></ul> <p>Information Retrieval</p> <ul style="list-style-type: none"><li>· Document Representation</li><li>· Retrieval Models</li><li>· Evaluation of Retrieval Performance</li></ul> <p>Semantic Web</p> <ul style="list-style-type: none"><li>· The Layered-Language Model</li><li>· Metadata and Ontologies</li><li>· Ontology Languages for the Web</li></ul> <p>Data Mining Techniques</p> <ul style="list-style-type: none"><li>· Classification and Association</li><li>· Clustering</li></ul> <p>Web Usage Mining</p> <ul style="list-style-type: none"><li>· Web-Log Processing</li><li>· Analyzing Web Logs</li><li>· Applications of Web Usage Mining<ul style="list-style-type: none"><li>o Clustering of Web Users</li><li>o Classification Modeling of Web Users</li><li>o Association Mining of Web Usages</li><li>o Sequence-Pattern Analysis of Web Logs</li></ul></li></ul>

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	<p>Web Content Mining</p> <ul style="list-style-type: none"><li>· Web Crawlers</li><li>· Search Engines</li><li>· Personalization of Web Content</li><li>· Multimedia Information Retrieval</li></ul> <p>Web Structure Mining</p> <ul style="list-style-type: none"><li>· Modeling Web Topology<ul style="list-style-type: none"><li>o PageRank Algorithm</li><li>o Hyperlink-Induced Topic Search (HITS)</li><li>o Random Walks on the Web</li></ul></li><li>· Social Networks</li><li>· Reference and Index Pages</li></ul>
	<p><b>References</b></p> <ol style="list-style-type: none"><li>1. Akerkar, R. &amp; Lingras, P. (2008). Building an Intelligent Web: Theory and Practice. Jones and Bartlett Publishers, Sudbury, Massachusetts. ISBN-13: 978-0-7637-4137-2</li><li>2. Witten, Ian H. &amp; Frank, E. (2005). Data Mining: Practical Machine Learning Tools and Techniques. 2<sup>nd</sup> Edition, Morgan Kaufman. ISBN 0120884070, 9780120884070</li><li>3. Reprint journal articles and conference proceedings.</li></ol>

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**BSCDA-505: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND  
MACHINE LEARNING**

**Objectives**

To enable the students to:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence
- To provide a basic exposition to the goals and methods of Artificial Intelligence
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning

<b>Units</b>	<b>Course Content</b>
1	Advanced Algorithms and Analysis Machine Learning Techniques Artificial Intelligence and Neural Networks Statistical Modeling for Computer Sciences Artificial Intelligence and Neural Networks Lab Machine Learning Lab Computational Intelligence

**References**

1. Stewart Russell and Peter Norvig. " Artificial Intelligence-A Modern Approach ", 2nd Edition, Pearson Education/ Prentice Hall of India, 2004 References
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000. 2.
3. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.