



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Computer Applications

Name of the Program: BSC (Data Science)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
BSCDS401	Major	Database Management System	2	0	2	3	60	20	20	30	20

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST - Mid Sem Test.

***Teacher Assessment** shall be based on following components:

Quiz/Assignment/Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Educational Objectives (CEOs):

- To provide students with basic concepts in information system and the benefits of these systems
- To understand the role, requirement and operations that an analyst needed to analyze, design, and implement the systems
- To provide the knowledge of business data modeling for the designing of efficient information systems
- To explain the various issues related with Data Security.

Course Outcomes (COs): After completing this course the student will be able to:

- Understand the database systems concepts
- Design any Desktop application using an entity relationship diagrams (ERD) to express requirements and demonstrates skills to model data requirements and create data models.
- Apply the knowledge of the subject to any particular database implementation using SQL.
- To learn and understand various Database Architectures and Applications.
- To differentiate between data, information, and knowledge

UNIT-I

Introduction: Introduction to Databases, Purpose of Database System, Database system Vs file system, Database System concepts and architecture, Advantage of DBMS approach, various views of data, data independence, schema and subschema and instances, basic concepts of data models, Database languages, Database administrator and users, data dictionary.

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UNIT-II

ER model: basic concepts, notation for ER diagram, design issues, Entity types, mapping constraint, Concepts of keys: super, candidate, primary, alternate, foreign, weak and strong entity sets, inheritance.

UNIT-III

Relational Algebra: The structure, relational operations.

SQL: Introduction, basic structure of SQL, Characteristics and Advantage of SQL set operations, aggregate functions, null values, SQL data types and literals. SQL operators, Types of SQL commands. Simple and nested queries, views, join relations. Comparison between tables and views, updatable view..

UNIT-IV

Normalization: Introduction, non-loss decomposition, FD diagram, Normal forms upto fifth normal form

UNIT-V

Transaction, concurrency and Recovery: basic concepts, ACID properties, Transaction states, Implementation of atomicity and durability, concurrency control, deadlock, storage structure types, stable storage implementation, data access, recovery and atomicity- log based recovery, deferred Database modification.

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Text Books:

1. A Silberschatz, H.F Korth, Sudersan, "Database System Concepts", 6th Edition, MGH Publication 2013.
2. C.J. Date, "An introduction to Database Systems", 6th Edition, Pearson 2003.
3. Elmasri&Navathe, "Fundamentals of Database systems", 7th Edition, Pearson 2015.
4. B.C. Desai, "An introduction to Database systems", BPB.
5. RaghuRamakrishnan, "Database Management Systems", 3rd Edition, TMH 2014.

List of Experiments:

1. To study Basic SQL commands (create database, create table, use, drop, insert) and execute the following queries using these commands:
 - Create a database named Employee".
 - Use the database „Employee" and create a table „Emp" with attributes „ename", „ccity", „salary", „enumber", „caddress", „deptname".
 - Create another table „Company" with attributes, „cname", „ccity", „empnumber" in the database „Employee".
2. To study the viewing commands (select, update) and execute the following queries using these commands:
 - Find the names of all employees who live in Delhi.
 - Increase the salary of all employees by Rs.5,000.
 - Find the company names where the number of employees is greater than 10,000.
 - Change the Company City to Gurgaon where the Company name is TCS".
3. To study the commands to modify the structure of table (alter, delete) and execute the following queries using these commands.

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- Add an attribute named Designation to the table “Emp”.
 - Modify the table Emp, Change the data type of salary” attribute to float.
 - Drop the attribute, deptname from the table ”emp”.
 - Delete the entries from the table Company” where the number of employees are less than 500.
- To use (and, or, in , not in, between , not between , like , not like) in compound conditions and execute the following queries using them:
 - Find the names of all employees who live in Gurgaon and whose salary is between Rs.20,000 and Rs.30,000.
 - Find the names of all employees whose names begin with either letter “A or B”.
 - Find the company names where the company city is Delhi and the number of employees is not between 5000 and 10,000.
 - Find the names of all companies that do not end with letter A.
 - Using aggregate functions execute the following queries:
 - Find the sum and average of salaries of all employees in computer science department.
 - Find the number of all employees who live in Delhi.
 - Find the maximum and the minimum salary in the HR department.
 - To execute the following queries using study the grouping commands (group by, orderby)
 - List all employee names in descending order.
 - Find number of employees in each department where number of employees is greater than 5. List all the department names where average salary of a department is Rs.10,000.
 - To write SQL queries to
 - Alter table, Emp and make enumber as the primary key.
 - Alter table, Company and add the foreign key constraint.

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- Add a check constraint in the table Emp such that salary has the value between 0 and Rs.1,00,000.
- Alter table Company and add unique constraint to column cname.
- Add a default constraint to column ccity of table company with the value Delhi.
- Rename the name of database to "Employee1".
- Rename the name of table Emp to Emp1.
- Change the name of the attribute ename to empname.

10. To execute following queries using appropriate SQL statements to

- Retrieve the complete record of an employee and its company from both the table using joins.
- List all the employees working in the company TCS".

11. To study the various set operations and execute the following queries using these commands:

- List the enumber of all employees who live in Delhi and whose company is in Gurgaon or if both conditions are true.
- List the enumber of all employees who live in Delhi but whose company is not in Gurgaon.

12. To study the commands for views and execute the following queries using these commands:

- Create a view having ename and ccity.
- In the above view change the ccity to Delhi where ename is "John".
- Create a view having attributes from both the tables.
- Update the above view and increase the salary of all employees of IT department by Rs.1000.

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BSCDS402	DCC	Big Data Technologies (Hadoop)	2	0	2	3	60	20	20	30	20

Legends: L – Lecture; T – Tutorial/Teacher Guided Student Activity; P – Practical; Q/A –Quiz/Assignment/Attendance; MST – Mid Semester Test.

***Teacher Assessment** shall be based on following components:

Quiz/Assignment/Project/Participation in classactivities, given that no component shall exceed more than 10 marks

Course Education Objectives (CEOs): The objective of this course is to teach students about:

1. To familiarize the students with the need and scope of the subject.
2. Provide an exposure giving a strong foundation to the data analytics practices.
3. Big data computing technologies, Watson studio
4. Understand the challenges posed by distributed applications and how ZooKeeper is designed toHandle.
5. create a basis for the use of advanced investigative and computational methods to convertinformation to useful knowledge.
6. Develop an understanding of how business analytics is actually performed
7. Develop an understanding of the complete open-source Hadoop ecosystem and its near termfuture direction
8. Covers foundational techniques and tools required for data science and big data analytics likeHadoop, NoSQL MapReduce, BIGSQL, Watson studio.

Course Outcomes (COs):After the completion of the course the student will be able to:

1. understanding importance and scope of the subject
2. understand the technological foundations of the Big Data
3. differentiate the structured and unstructured data and different databases to store structured andunstructured data like Mongo DB, HBase etc.store and manipulate the different types of data.

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BSCDS402	DCC	Big Data Technologies (Hadoop)	2	0	2	3	60	20	20	30	20

- have a knowledge of HADOOP and Hadoop ecosystem and its uses in Big Data
- understand and apply the Big Data Analytics
- Understand the functions and features of HDP.
- To model and Design Big Data for analytics
- Understand the MapReduce model v1 and review java code.
- understand the professional and ethical responsibility
- to produce the good decision makers who can use empirical approaches, wide range of data analytic techniques to problem solving.

PRE- REQUISITES:

This course requires the familiarity with linear algebra, calculus, matrix operations, probability theory, statistics, programming, Database Management System, Data Mining and Warehousing

Syllabus

Unit I

Big Data: Introduction and basics, Evolution of Data Management, Definition, Importance, Big Data Types, Structured and unstructured Data, Sources of structured data and unstructured data, Characteristics of Big Data, Architecture of Big Data Management System, Stages of Big Data Management,

Unit II

Big Data and operational Databases: relational databases, non-relational databases and its types, spatial databases.

Big Data Technology Foundations: Technology Components, virtualization, distributed computing, Cloud in Big Data, Integration of data types into a big data environment.

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Unit III

Hadoop Foundation and Components of Hadoop Ecosystem, Appliances and Big Data Warehouse, Big data Implementation, Big Data Applications.

Hadoop and HDFS: Hadoop Distributed File System (HDFS), function of the Name-Node and Data-Nodes in a Hadoop cluster, files are stored, and blocks ("splits") are replicated. Hive, Sqoop.

Unit IV

Big Data Analytics: Introduction, Basic and Advanced Analytics, Drivers, Pillars of Analytics: descriptive, predictive, and prescriptive. Core Components of analytical data architecture, Performance issues, Parallel vs. distributed processing, Shared nothing data architecture and Massive parallel processing, Elastic scalability, Data loading patterns. Data Analytics lifecycle.

Unit V

MapReduce and YARN: MapReduce model v1, the limitations of Hadoop 1 and MapReduce, handling the Mapper class with Java, Reducer class and the program driver needed to access MapReduce, the YARN model, Hadoop 2/YARN versus Hadoop 1, Introduction to Apache Ambari, Introduction of Hortonworks Data Platform – HDP: functions and features of HDP, the IBM value-add components, basics of IBM Watson Studio, description of the purpose of the value-add components . Introduction to Zookeeper, Slider, and Knox. Introduction to Spark.

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BSCDS402	DCC	Big Data Technologies (Hadoop)	2	0	2	3	60	20	20	30	20

TEXTBOOKS:

1. “Introduction to Infosphere Big Insights”, IBM Career Education
2. “Changing Business with Data Insight”, IBM Career Education
3. “Big Insights Analytics for Business Analysts”, IBM Career Education
4. “Hadoop: The Definitive Guide Paperback – 2015” by Tom White, Shroff Publishers & Distributors Private Limited - Mumbai; Fourth edition (2015).
5. “Big Data and Hadoop” by V. K. Jain, Khanna Publishers; 1 edition (1 June 2015)
6. “Big Data for Dummies” by Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman Wiley, ISBN: 978-1-118-50422-2, 2013
7. “Data Analytics, Models, Algorithms for Intelligent Data Analysis by Thomas A., Springer Vieweg, ISBN 978-3-8348-2589-6, 2013
8. “Hadoop For Dummies”, Dirk deRoos, For Dummies, 2014.

REFERENCE BOOKS:

1. “Big Data: A Revolution That Will Transform How We Live, Work, and Think” by Kenneth Cukier, Viktor Mayer-Schönberger; Mariner Books; Edition (2014)
2. “Big Data: Using Smart Big Data, Analytics and Metrics to Make Better” by Bernard Marr; Wiley; Edition 1st (2015)
3. “Mining of Massive Datasets, Chapter 2”, by Ullman, Rajaraman,
4. “MapReduce and Parallel DBMS” by Stonebraker et al.,: Friends or Foes?, Communications of the ACM, January 2010.
5. “MapReduce: A Flexible Data Processing Tool” by Dean and Ghemawat, Communications of the ACM, January 2010.

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BSCDS402	DCC	Big Data Technologies (Hadoop)	2	0	2	3	60	20	20	30	20

List of Practical:

1. Installation of Virtual Machine.
2. Installation of Hadoop
3. Installation of Pig
4. Installation of HBase and Sqoop
5. Installation of Hive and creating database.
6. Introduction to Zookeeper.
7. Creating Mapper function using Python
8. Creating Reducer function using Python
9. Python Iterator and Generator.
10. Word Count program in Map Reduce.

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BSCDSMA401	DCC	Time Series Analysis	3	0	0	3	60	20	20	0	0

Course Objective

To introduce the students to the fundamentals of the Time Series Analysis.

Course Outcomes

After the successful completion of this course students will be able to:

- 1. Forecast the trend pattern exhibited by the given data by using various methods.*
- 2. Run and interpret time series models and regression models for time series.*
- 3. Analyze and estimate the cyclic components using special processes.*

Course Content:

UNIT – I

Introduction, component of time series: - trend, periodic changes, irregular component. Analysis of time series: - mathematical models for time series, uses of time series.

UNIT– II

Measurement of trend: - graphic method, method of semi averages, method of curve fitting by principle of least square, growth curves and their fitting, moving average method, approximation to moving averages.

UNIT – III

Measurement of seasonal variation: - method of simple averages, ratio to trend method, ratio to moving average method, link relative method, de-seasonalisation of data. Method of cyclic variation.

UNIT – IV

Auto regression series: - first order auto regression series (markoff's series), second order auto regression series (yule's series), general auto regression.

UNIT – V

Study of the stationary processes: (1) moving average (ma), (2) auto regressive (ar), (3) Auto regressive moving averages (arma) and (4) Auto Regressive integrated moving Averages (arima) models.

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BSCDSMA401	DCC	Time Series Analysis	3	0	0	3	60	20	20	0	0

SUGGESTED READING:

1. S.C. Gupta and V.K. Kapoor, Fundamentals of applied Statistics, S Chand & Co.
2. Jim Frost, Introduction to Statistics: An Intuitive Guide for Analyzing Data and Unlocking Discoveries, Jim Frost MS.
3. Douglas C. Montgomery, Cheryl L. Jennings and Murat Kulahci. Introduction to Time Series Analysis and Forecasting.
4. James D. Hamilton. Time Series Analysis.

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BSMAT 402	DCC	Numerical Methods	3	0	0	3	60	20	20	0	0

Course Objective

To introduce the students with the fundamentals of the Numerical Methods.

Course Outcomes

After the successful completion of this course students will be able to:

- 1. Apply various numerical methods to obtain numerical solution of definite integration and algebraic and transcendental equations.*
- 2. Learn various techniques of getting solution of linear system of equation.*
- 3. Use various techniques of interpolation methods.*
- 4. Learn various techniques of numerical differentiation and numerical Integration.*
- 5. Find numerical solution of ordinary differential equation.*

Course Content:

UNIT – I

Numerical errors, Numerical methods for solving nonlinear equations: Method of bisection, Secant method, False position method, Newton-Raphson method, Fixed point method.

UNIT – II

Linear Equations: Direct Methods for Solving Systems of Linear Equations (Gauss-Jordan Elimination, LU Decomposition), Iterative Methods (Jacobi, Gauss-Seidel Reduction Methods).

UNIT – III

Introduction to Interpolation, Calculus of finite differences, Difference Operators, Relation between Operators, Interpolation with equal interval: Newton's Forward and Backward Interpolation formula.

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UNIT – IV

Interpolation with unequal interval: Newton divided difference interpolation formula and Lagrange's interpolation Formula, Lagrange's Inverse interpolation Formula.

UNIT – V

Numerical Differentiation and Integration: Discrete Approximation of Derivatives: Forward and Backward Difference Forms, Numerical Integration: Simson's $1/3$, Simson's $3/8$. Ordinary Differential Equations: Euler Method, Runge-Kutta's Method.

Reference Book:

1. S. S. Sastry, Introductory Methods of Numerical Analysis, P11.1 Learning Pvt. Ltd.
2. Balaguruswamy, Numerical Methods. Tata McGraw Hill Publication, New York.
3. Numerical Methods: R.K. Jain, S.R.K. Iyenger, New Age International Publisher.
4. Higher Engineering Mathematics: B.S. Grewal, Khanna Publisher

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