Course Handout

Semester: VII
Academic Year: 2019-20
Course Code: CS 3102
Course Title: Advanced Databases
LTPC: 2044
Programme: Bachelor of Technology
Course-in-charge: Dr. Vikas Malviya
Co-instructor:

1. Course Description

This course aims at furthering database systems concepts through adding complexity and a more hands-on approach. This course is study of data warehousing system and basics of non-relational data models. The goal of the course is to familiarize the students with basics of non-relational database systems.

2. Course Content

Unit 1. **Data Warehousing and Mining:** Introduction to Data warehousing, Multidimensional Model/ Data Modelling, Hierarchy of Data, Multidimensional Schema, Star Schema, Snowflake Schema, Fact Constellation.

Unit 2. Overview of NoSQL Database, Why NoSQL, Database fundamentals - RDBMS vs NoSQL, technology foundations, CAP theorem and its impact, Use of NoSQL with respect to need in industry and their corresponding data, Key value Databases, Document databases, Graph Databases, Column Family Databases.

Unit 3. **Key Value Databases:** Introduction to Redis, Environment Configuration, Data Types, Redis Commands, Querying Data, Creating applications with Redis.

Unit 4. **MongoDB basics:** Introduction to MongoDB, How to configure MongoDB with Applications, CRUD operation with MongoDB, Querying data using MongoDB.

Unit 5. **Graph Databases:** Basic Graph Theory, Working with Neo4J - nodes, relations and properties, Querying with CypherQL.

Unit 6. **Column Family Databases:** Cassandra NoSQL Database, CRUD operation with Casandra DB, Where to use Casandra over MongoDB, Using Cassandra with Applications.

3. Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand technique of data modeling and schema in data warehousing
CO2	Apply data warehousing with real world data.

CO3	Understand different types of non-relational database management system.
CO4	Decide which type of database system to use in which case.
CO5	Implement applications with NoSQL databases

4. Course Outcomes Mapping with Programme Outcomes

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	H	L	L	L	L	L	L	L	L	L	L	L	H	L	M
CO2	H	H	H	L	H	H	L	L	H	L	L	H	H	L	M
CO3	H	L	L	L	H	L	L	L	L	L	L	L	H	L	M
CO4	H	H	L	L	L	L	L	L	L	L	L	H	H	L	M

Note: H- High**, M-** Moderate**, L-** Low and **NA**- Not Applicable

5. Session Plan

Lecture No.	Topics	Course Outcome
1-5	**Data Warehousing and Mining** • Introduction to Data warehousing. • Multidimensional Model/ Data Modelling. • Hierarchy of Data • Multidimensional Schema • Star Schema • Snowflake Schema • Fact Constellation.	CO1, C02
6-8	• Overview of NoSQL Database. • Why NoSQL • Database fundamentals - RDBMS versus NoSQL technology foundations • CAP theorem and its impact • Use of NoSQL with respect to need in industry and their corresponding data. • Key value Databases • Document databases • Graph Databases • Column Family Databases	C03
9-13	**Key Value Databases:** • Introduction to Redis	C03, C04, C05

	• Environment Configuration • Data Types • Redis Commands • Querying Data • Creating applications with Redis	
14-19	**MongoDB basics:** • Introduction to MongoDB • How to configure MongoDB with Applications • CRUD operation with MongoDB • Querying data using MongoDB	C03, C04, C05
20-24	**Graph Databases:** • Basic Graph Theory • Working with Neo4J - nodes, relations and properties • Querying with CypherQL	C03, C04, C05
25-30	**Column Family Databases:** • Cassandra NoSQL Database • CRUD operation with Casandra DB • Where to use Casandra over MongoDB • Using Cassandra with Applications	C03, C04, C05

6. Evaluation Scheme

Evaluation Components	Mode of Exam	Date & Day	Time	Weightage
Mid Semester – I	Online	As per academic calendar	1 Hour	15%
Mid Semester – II	Online	As per academic calendar	1 Hour	15%
Comprehensive Exam	Online	As per academic calendar	2 Hours	30%
Lab Assignments + Viva	Offline		Throughout the course	30%
Attendance	-	Throughout the course		10%

***Course Practical Evaluation Scheme is as follows:**

Evaluation Components	Weightage (20%)
Lab Assignments	15%

Viva Voce	15%

7. Course Outcomes Mapping with Evaluation Components

Course Outcomes	Mid-Sem I	Mid-Sem II	Comprehensive/ End Sem	Practical	Viva
CO1	L	L	H	H	H
CO2	L	L	H	H	H
CO3	H	H	H	H	H
CO4	H	H	H	H	H

H- High**, M-** Moderate**, L-** Low and **NA**- Not applicable

8. Attendance Policy

As per Attendance policy of the University

9. Make up Policy

Students who are likely to miss a component of evaluation on a genuine reason may be given a make-up of that component by the Course In-Charge. The students are required to approach either of the Course In-Charge immediately for the same before the conduct of the evaluation component. It is the responsibility of the student to approach the Course In-Charge. The Course In-Charge will not allow makeup, if student approach 7 days after the Examination. The grant of a makeup exam or lab session is solely at the discretion of the course-in-charge. His decision in the matter will be final.

10. Plagiarism

Instances of plagiarism in exams will be dealt with in accordance with the rules set by the University in this connection. In case of plagiarism in lab assignments, zero marks will be given in that particular assignment.

11. Grading Policy

A composite score will be prepared after consolidating the marks obtained in all assessment components and the composite score will be converted to letter grades, viz. A, B, C, D and E as per university policy.

12. Pedagogy

MS-PowerPoint Presentations, Videos and Animation of few lectures, as well as Open Course Ware Websites will be used as teaching methodologies.

13. Text Books

TB1. T Ozsu and P. Valduriez, Principles of Distributed Database Systems, Prentice Hall, 2011, ISBN: 978-1-4419-8833-1.

TB2. Dan Sullivan, Addison-Wesley, NoSQL for Mere Mortals, 1st edition, 2015, ISBN-10: 0134023218.

14. Reference Books

RB1. Alex Berson, Data Warehousing, Data Mining, and OLAP, McGraw Hill Education, 2017, ISBN-10: 0070587418.

RB2. Kristina Chodorow, MongoDB: The Definitive Guide, 2nd Edition, O'Reilly Media, 2013, ISBN-10: 1449344682.

RB3. Ian Robinson, Jim Webber and Emil Eifrem, Graph Databases, O'Reilly Media, 2nd Edition, 2015, ISBN-10: 1491930896

RB4. Eben Hewitt and Jeff Carpenter, Cassandra: The Definitive Guide, O'Reilly Media, 2nd Edition, 2016, ISBN-10: 1491933666.

RB5. Herbert Schildt, Java - The Complete Reference, Mcgraw Hill Education, 9th Edition, 2014, ISBN-10: 0071808558

RB6. Redis Cookbook, Tiago Macedo and Fred Oliveira, O'Reilly Media, First Edition, 2011, ISBN: 978-1-449-30504-8

15. List of Practical/Experiments

P1. Configuration of Redis and creating applications with Java

P2. Installation of MongoDB and creating applications with MongoDB and Java

P3. Querying database with CypherQL

P4. Demonstration and use of Cassandra for real time applications

P5. Installation of Neo4J and developing real time applications with Neo4J and Java

P6. Real time use cases of Data warehousing

16. Consultation Hour

All information regarding course will be posted on Moodle. The student may approach the Course-In-Charge for any clarification or removal of their difficulties by prior appointment fixed via email.