DETAILED SYLLABUS

Department of Computer Science
University of Lucknow, Lucknow
M.Sc. (Computer Science) First Semester Syllabus

Course Title: Database(Oracle)	**Objective:** The objective of this course is to impart sound knowledge of Database theory and hands on practical skills to work on various DBMS and RDBMS. The students are taught to manage data effectively and to access effectively.
Course Code: MCS -101	
Paper Number: I | **Credit : 04**	
Maximum Marks: 100	

Unit -I

Database Definition, Purpose of Database, DBMS Versus RDBMS, F. Codd's twelve rules, Database Modelling for a Database, Entities and attributes, Entity-relationship model, Three level of data abstraction, Characteristics of Database.

Unit –II

Data Models, Instances and Schemas, Data Independence. Structure of DBMS, Advantages and Disadvantages of DBMS. Data Dictionary, Database components, Data definition language, Data Manipulation language, Keys: primary keys, candidate keys, composite keys,

Unit –III

Generalization and aggregation, Relational Data Model, Network Data Model, Hierarchical Model, Normalization, Transaction Processing and Concurrency Control, Database Recovery concepts, Definition of Transaction and ACID properties, Normalization through Synthesis, Functional dependencies and semantics, Synthesis approach, Synthesis Algorithm, Multivalued Dependencies.

Unit –IV

Study of various Concurrency Control Techniques, Deadlocks, Database security and Authorization, Database Security issues, Views, Clustering, Joins Parallel Databases: I/O Parallelism, Inter and Intra Query Parallelism – Inter and Intra operation Parallelism, De-normalization for performance, ACID properties.

Unit –V

Distributed Database system, Implementation of DDL and DML with Oracle software, Insertion and retrieving records from oracle database, database connection with web application, Relational Database Design, Features of Good Relational Designs, Decomposition using Functional Dependencies, Boyce-Codd normal form, BCNF and Dependency Preservation.

Outcome of Course:

At the end of this Course, the successful student will be:

- able to understand the database concepts and DBMS components and their functions, RDBMS software.
- able to model an application's data requirements using conceptual modelling tools like ER diagrams and design database schemas based on the conceptual model.

Recommended Books

[1] Elmasri, Navathe, Somayajulu and Gupta, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2006.

[2] Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2013

[3] Bipin C. Desai, "An Introduction to Database Systems", Revised Edition, Galgotia PUblication, 2017.

[4] Jason Price, "Oracle Database 12c SQL", first Edition, McGraw Hill, 2017.

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Course Title: Data Warehouse and Data Mining	**Objective:** The objective of this course is to learn how data warehousing and data mining work together to extract precious insights from vast data. This course helps students to pull raw data from different sources and store it in a cleaned, standardized form, to facilitate real time data analysis for scientific purpose.
Course Code: MCS -102	
Paper Number: II **Credit : 04**	
Maximum Marks: 100	

Unit –I

Data Warehousing Definition, Need for data warehousing, Characteristics of data warehouse, paradigm shift, Operational and Informational data stores, Database versus Data warehouse, advantages of Data warehousing, Benefits of data warehouse (tangible and Non-tangible) Multi-Dimensional Data Model, Data Cubes, Data mart.

Unit –II

Data warehouse architecture and Components, Meta Data, Data warehouse and operational data stores, Multi-layered data ware house architecture, Overview of Client/Server Architecture, Host based processing, Master-slave Processing, first generation client/server Processing,

Unit –III

Second generation client/server Processing, Server function, Access tools, Query and Reporting tools, Stars Schema, Multi-Star schema , Data warehousing Process Architecture, 3 Tier Architecture,. Need for OLAP, OLAP Guidelines, OLAP function and Tools, OLAP Servers, ROLAP, MOLAP, HOLAP, Information Delivery system, Building a Data warehouse,

Unit –IV

Design consideration, Nine Decisions in designing data warehouse, Data warehouse Implementation consideration, Data extraction, Cleanup, transformation and migration, data warehouse Administration and Management, Relational Database technology for Data warehouse, Types of Parallelism, Data partitioning,

Unit –V

Database architectures for parallel Processing: shared memory architecture and shared disk architecture, shared nothing architecture, parallel RDBMS features, Sybase, STAR join and STAR index. Oracle server architecture. Data Mining Definition and interface, data mining process, mining techniques, , Cluster analysis and web data mining, support vector machines.

Outcome of Course:

At the end of this Course, the successful students will be able to:

- Create a clean, consistent repository of data within a data warehouse for large corporations.
- discover interesting patterns in large databases with the help of data mining techniques.
- Use existing commercial or public-domain tools to perform data mining tasks to solve real problems in business and commerce.

Recommended Books

[1] Alex Berson and Stephen J. Smith, "Data warehousing, Data Mining & OLAP", Second edition, Tata McGraw-Hill Publication, 2006.

[2] Arun K Pujari, " Data Mining Techniques", Second edition, University press 2009.

[3] Rajan Chattamvelli, " Data Mining Methods",Second edition, Narosa Publishing, 2016.

[4] G. K Gupta, "Introduction to data mining with caste studies", second edition, PHI publication, 2017.

24/2/2020 24/2/2020 24/02/2020

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Course Title: Theory of Computation	**Objective:** The objective of this course is to impart the knowledge of mathematical foundations of computation including automata theory, theory of formal languages and grammars, notions of algorithm, complexity, and computability.
Course Code: MCS -103	
Paper Number: III **Credit : 04**	
Maximum Marks: 100	

Unit –I

Fundamentals – alphabets, strings, languages, problems, graphs, trees, Finite State Systems, definitions, Finite Automaton model, acceptance of strings, and languages, Deterministic finite automaton and Nondeterministic finite automaton, transition diagrams, transition tables, proliferation trees and language recognizers, equivalence of DFA's and NFA's. Finite Automata with ε-moves, Moore and Melay machines.

Unit –II

Regular Languages: regular sets, regular expressions, identity rules, constructing finite automata for a given regular expressions, conversion of finite automata to regular expressions. Pumping lemma of regular sets and its applications, closure properties of regular sets. Grammar Formalism: Regular grammars–right linear and left linear grammars,

Unit –III

Equivalence between regular linear grammar and finite automata, inter conversion, Context free grammar, derivation trees, sentential forms, right most and leftmost derivation of strings, ambiguity, Context Free Grammars: Simplification of Context Free Grammars, Chomsky normal form, Greibach normal form, Pumping lemma for context free languages and its applications,

Unit –IV

Closure of properties of CFL (proofs omitted). Push Down Automata: PDA definition, model, acceptance of CFL, acceptance by final state and acceptance by empty state and its equivalence. Equivalence of PDA's and CFL's, inter-conversion. (Proofs not required), Membership Algorithm (CYK Algorithm) for Context Free Grammars. Turing Machine, TM definition, model, design of TM, computable functions.

Unit –V

Unrestricted grammars, recursively enumerable languages. Church's hypothesis, counter machine, types of Turing machines (proofs omitted). Linear bounded automata and Context sensitive language. Computability Theory: Chomsky hierarchy of languages, Parsing, types of parsing, DPDA, LR(0) grammar, decidability and undecidable problems. Definitions of P and NP problems, NP complete and NP hard problems.

Outcome of Course:

At the end of this Course, the successful students will be able to:

- Perform computation and Implement the automata Theory.
- Develop the models of Computation, including formal languages, grammar and automata.
- Analyze and design finite automata, pushdown automata, Turing machines, formal languages.

Recommended Books

[1] John E. Hopcroft, Rajeev Motwani and Jeffery D. Ullman, Automata Theory, Languages, and Computation, Third Edition, Pearson Education, 2008.

[2] Michael Sipser, Introduction to the Theory of Computation, Third Edition, Cengage Learning, 2012.

[3] Peter Linz, "An Introduction to Formal Language and Automata", Six Edition, Cengage Learning, 2016.

[4] A.M Natarajan, A. Tamilarasi, P. Balasubramani, "Theory of Computation", First Edition, New Age International publishers, 2014.

24/12/2020 24/12/2020 24/12/2020

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Course Title: Information Security	**Objective:** The objective of this course is to learn basics of information security and network security. Identify various types of security incidents and attacks, and learn methods to prevent and detect. Students shall also learn Hardware security, software security and Database security.
Course Code: MCS -104	
Paper Number: IV **Credit : 04**	
Maximum Marks: 100	

Unit –I

Information Security and Information System: Overview, need for information security, objectives of Information security, Security Attacks, Global information systems and their evolution, basics of information systems, role of the Internet and the World Wide Web -Understanding about the threats to information systems security Building blocks of InfoSec.

Unit –II

How Organizations manage security of their information systems, Information security risk analysis fundamentals, Importance of physical security and biometrics controls for protecting information systems assets, Security Policy, Security Procedures, Building a security plans, System Security Management. Authentication application, Kerberos, PGP, SSL and TLS

Unit –III

Goals of Security infrastructure, Data confidentiality, Data Integrity, Data availability, Security Models. Cryptography, Terminology, Encryption Algorithm, Cryptanalysis, Data encryption methods, cryptographic algorithm, Secret key Cryptography, Public key Cryptography.

Unit –IV

Hardware Security, Software Security, Intrusion Detection Systems and Firewalls, security of virtual private networks - Security issues in application development with emphasis on integration of enterprise applications, database security, operating security and security of electronic mailing systems, E-commerce Security.

Unit –V

Database security, Cyberspace security, Host based security, Network based Security, Host-Base IDS versus Network-Based IDS, Critical National Infrastructure and its security, Confidentiality-Integrity-Availability Triad, Defensive Life-Cycle, Critical Intrusion Detection and Prevention Principles.

Outcome of Course:

At the end of this Course, the students will be able to:

- Develop an understanding of security policies for various information systems (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.
- Students able to develop security methods such as encryption, decryption and IDS.
- Determine appropriate mechanisms for protecting information systems ranging from operating systems to database management systems.

Recommended Books

[1] Brijendra Singh, "Network Security and Management" , Third edition, PHI publication, 2012.

[2] W. Stallings, "Network Security Essentials: Applications and Standards", First edition, Pearson Publications, 2015.

[3] Nina Godbole, "Information Systems Security Management: Security Management, Metrics, Frameworks and Best Practices, Second edition, Wiley Publication, 2017.

24/2/2020

Department of Computer Science
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Course Title: Lab based on MCS 101	**Objective:** The objective of this lab is to impart the knowledge of how to store and organize the data in various DBMS and RDBMS software, and to retrieve the stored data efficiently to fulfil the individuals and organizational needs.
Course Code: MCS -105	
Practical / **Credit : 04**	
Maximum Marks: 100	

Practical Paper

List of Exercise based on Database (Oracle)

1. Creating Database.
2. Creating database with schema.
3. Implementation of DML and DDL Command.
4. Implementation of Primary key,
5. Implementation of foreign key,
6. Implementation of Candidate key
7. Implementation of composite key.
8. Submitting and retrieval of records through firing queries from/to database.
9. Implementation of inner joins.
10. Implementation of left outer joins.
11. Implementation of right outer joins.
12. Implementation of right outer joins.
13. Implementation of full outer joins.
14. Implementation of creating, updating and dropping Views
15. Implementation of Clustering
16. Database Connection with web application.
17. Implementation of Database recovery.
18. Implementation of Database extraction and authentication.

Outcome of Course:

At the end of this Course, the successful students will be able to:

- Storing data and organizing it for future purpose.
- Securing and backing up data
- Normalizing data.
- Managing relationships between data-tables and databases.

Recommended Books

[1] Elmasri, Navathe, Somayajulu and Gupta, "Fundamentals of Database Systems", Fifth Edition, Pearson Education/Addison Wesley, 2006.
[2] Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2013.
[3] Bipin C. Desai, "An Introduction to Database Systems", Revised Edition, Galgotia PUblication, 2017.
[4] Jason Price, "Oracle Database 12c SQL", first Edition, McGraw Hill, 2017.

24/02/2020 24/02/2020

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Course Title: Lab based on MCS 102	**Objective:** The objective of this course is to make students aware about the various data mining techniques and algorithms and providing them practical exposure in order to implement these techniques and algorithms to know the pros and cons of each one and selecting appropriate data mining techniques for solving real time problem.
Course Code: MCS -106	
Practical / **Credit : 04**	
Maximum Marks: 100	

Practical Paper

List of Exercise based on Date Warehouse and Data Mining.

1. Create an Employee Table with the help of Data Mining Tool WEKA.
2. Create a Weather Table with the help of Data Mining Tool WEKA.
3. Apply Pre-Processing techniques to the training data set of Weather Table.
4. Apply Pre-Processing techniques to the training data set of Employee Table.
5. Normalize Weather Table data using Knowledge Flow.
6. Normalize Employee Table data using Knowledge Flow.
7. Finding Association Rules for Buying data.
8. Finding Association Rules for Banking data
9. Finding Association Rules for Employee data.
10. To Construct Decision Tree for Weather data and classify it.
11. To Construct Decision Tree for Customer data and classify it.
12. To Construct Decision Tree for Location data and classify it.
13. Write a procedure for Visualization for Weather Table.
14. Write a procedure for Visualization of Banking Table.

Outcome of Course:

At the end of this Course, the successful students will be able to:

- Understand the functionality of the various data mining and data warehousing component.
- Identify strengths and limitations of various data mining and data warehousing models.
- Describe different methodologies used in determining and data ware housing.

Recommended Books

[1] Alex Berson and Stephen J. Smith, "Data warehousing, Data Mining & OLAP", Second edition, Tata McGraw-Hill Publication, 2006.

[2] Arun K Pujari, " Data Mining Techniques", Second edition, University press 2009.

[3] Rajan Chattamvelli, " Data Mining Methods",Second edition, Narosa Publishing, 2016.

[4] G. K Gupta, "Introduction to data mining with caste studies", second edition, PHI publication, 2017.

24/04/2020

04/02/2020