Program Name : **Diploma in Information Technology**

Program Code : **IF**

Semester : **Third**

Course Title : **Principles of Database**

Course Code : **22321**

1. RATIONALE

Database management system stores, organizes and manages a large amount of data which can be used by different software application. Developing and managing efficient and effective database applications requires understanding the fundamentals of database management systems and techniques for the design of databases by following principles of database design. This course enables students comprehending concept of database, they can design relational database and perform basic operations on stored data.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Develop Relational Database by applying principles of database design.**

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following ***industry oriented*** COs associated with the above mentioned competency:

a. Use fundamental concepts of database in a Database System.
b. Choose relevant data model to solve a problems.
c. Develop relational databases using Entity Relationship modelling approach.
d. Apply constraints for data integrity in Relational database.
e. Apply data normalization and denormalization techniques on database.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
				Theory							Practical					
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(*): Under the theory PA: Out of 30 marks, 10 marks of theory PA are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the UOs required for the attainment of the COs.

Legends: ***L****-Lecture;* ***T*** *– Tutorial/Teacher Guided Theory Practice;* ***P*** *- Practical;* ***C*** *– Credit,* ***ESE*** *- End Semester Examination;* ***PA*** *- Progressive Assessment*

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the

course. in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.

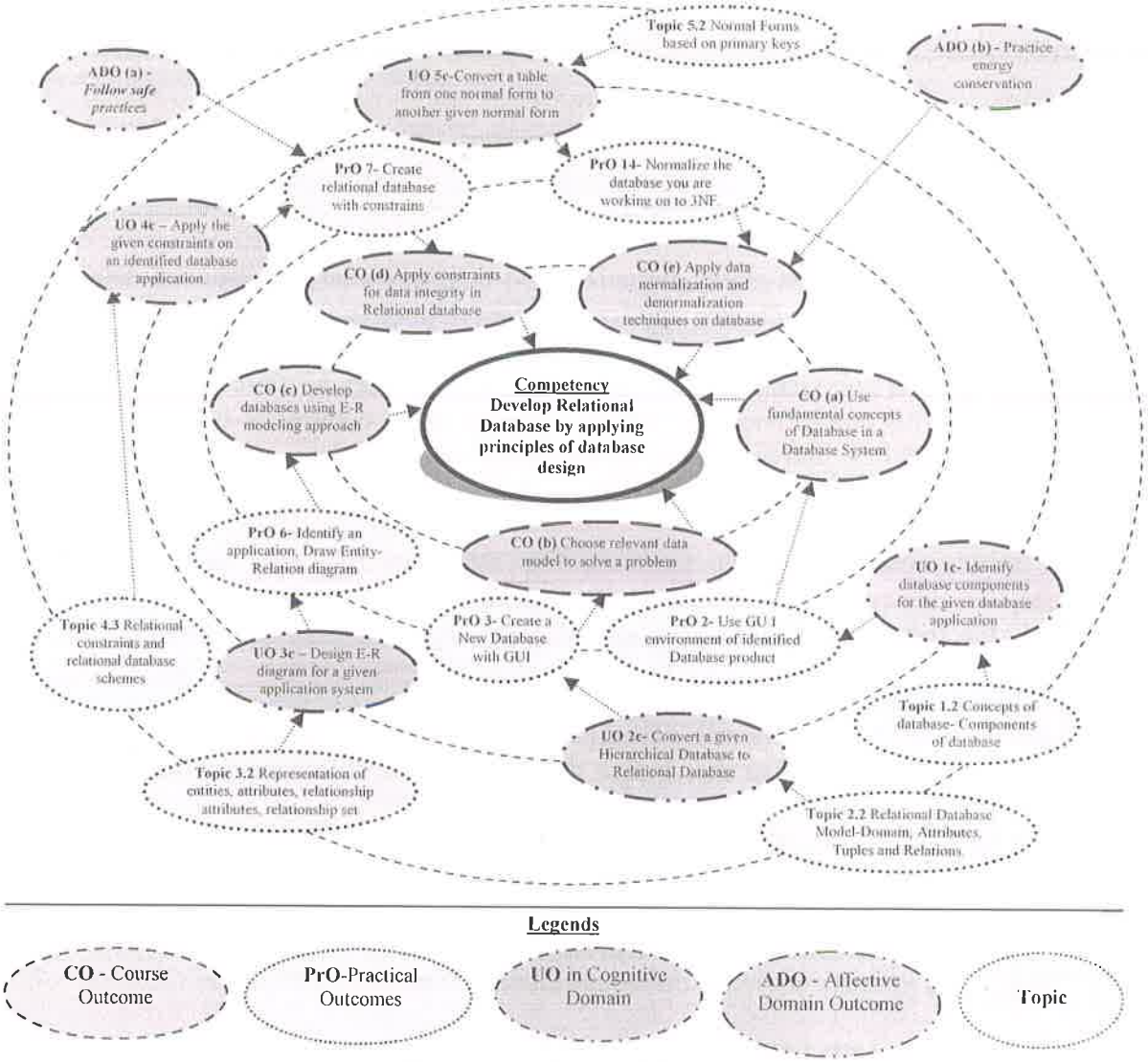

Figure 1 - Course Map

6. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency:

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
1	Install database Product.	I	02*
2	Use GUI (Graphical User Interface) environment of identified Database product.	I	02
3	Create a New Database with GUI (Graphical User Interface).	II	02*
4	Create a Table structure with database GUI.	II	02
5	Insert Records in table(s).	II	02
6	Identify an application, Draw Entity-Relation diagram and Design database. Create table(s) and insert some records in it - Part I	III	02*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
7	Identify an application, Draw Entity-Relation diagram and Design database. Create table(s) and insert some records in it. Part II	III	02
8	Create a relational database with constraints: Domain constraints, Key constraints, Not Null.	IV	02*
9	Create relations between the tables in database.	IV	02
10	Create Queries to perform different operations using GUI. Part I	IV	02
11	Create Queries to perform different operations using GUI. Part II	IV	02
12	Update and Replace Data in Database.	IV	02
13	Sort Records in the table Using given criteria.	IV	02
14	Filter the Data in the table based on criteria.	IV	02
15	Import and Export database to desired format.	IV	02
16	Normalize the database you are working on to 3NF.	V	02*
	Total		**32**

Note

*i. A suggestive list of **PrOs** is given in the above table. More such PrOs can be added to attain the COs and competency. A judicial mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.*

ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
a.	Correctness of database design	40
b.	Accuracy of Operations using GUI	30
c.	Answer to sample questions	15
d.	Submit report in time	15
Total		**100**

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

a. Follow safety practices.
b. Practice good housekeeping.
c. Demonstrate working as a leader/a team member.
d. Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1st year
- 'Organising Level' in 2nd year and
- 'Characterising Level' in 3rd year.

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	PrO S. No.
1	Computer system- • **Operating System:** Windows 7 or higher • **Memory:** 2 GB RAM or higher • **Processor Speed:** Intel Core i3 or higher • **Hard Drive:** 500 GB or larger • **DVD Drive:** DVD +/- RW	All
2	Database Management System product with Graphical User Interface such as MS-ACCESS, MySQL, MariaDB	

8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit – I Basics of Database and Architecture	1a. Distinguish the data and information based on their characteristics in the given context. 1b. Identify database components for the given database application. 1c. Differentiate the features of the given databases with examples. 1d. Explain the three level of architecture of database for the given application system.	1.1 Introduction: Data, Database and its purpose, Characteristics of the database, file system vs. database approach, Different types of Database, Advantages and disadvantages of database systems. 1.2 Concepts of database: Components of database- Hardware, Software, People, Procedure.Database Product, Data abstraction, Database languages –Data Definition Language(DDL), Data Manipulation Language(DML), Data Control Language(DCL).Data independence - Logical and Physical Independence, Data integrity. 1.3 Architecture of data base: Three Level Architecture for a Database System- Database (Data) Tier, Application (Middle) Tier and User (Presentation) Tier.
Unit– II Data Models and database types	2a. Explain the efficiency and storage complexity of the given data models. 2b. Explain the merits and draw backs of the given data model. 2c. Convert a given Hierarchical Database to Relational database. 2d. Represent a dataset in the	2.1 Database Models- Hierarchical Database Model. Network Database Model, Object-Oriented Database Model. 2.2 Relational Database Model- Domain, Attributes, Tuples and Relations. 2.3 Types of Database System-Centralized Database System, Parallel Database System, Client / Server Database System, Distributed Database System

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	given data model graphically.	
Unit– III Database Design using ER model	3a. Represent identified entities set and their relationship in terms of tables for the given application system. 3b. Use relevant types of Key to establish the given type of relation between tables. 3c. Design E-R diagram for the given application system. 3d. Identify the shortcomings of ER modeling approach for the given system to resolve it through EER approach.	3.1 Entities, Entity set, Relationships 3.2 Representation of entities, attributes, relationship attributes, relationship set 3.3 Generalization, aggregation 3.4 Structure of relational Database and different types of keys. Expressing M: N relation 3.5 Shortcomings of ER Model, Enhanced ER (EER) model; sub class, super class, Specialization and Generalization.
Unit-IV Relational Data Base Model	4a. Apply relevant key in database to comply the given constraints. 4b. Describe with sketches the schema diagram of the given database. 4c. Apply the given constraints on the specified identified database application. 4d. Write procedure to manipulate the given table by adding/ modifying/ deleting records.	4.1 Database schema and subschema 4.2 Relational databases and relational database schemes, Entity integrity, referential integrity and foreign key. 4.3 Relational constraints and relational database schemes-Domain constraints, Key constraints, Not Null. 4.4 Codd's rules of RDBMS. 4.5 Working with RDBMS: Create table, insert values in the table, edit table, delete table using appropriate GUI based database.
Unit –V Normalization	5a. Derive Functional Dependency of the given attribute in a table. 5b. Identify the Normal Form of the given table. 5c. Convert the given table from one normal form to another given normal form. 5d. Denormalize the given database by introducing data redundancy or data grouping.	5.1 Concept of Normalization, Functional Dependency, Closures of a Set of Functional Dependencies. 5.2 Normal Forms based on primary keys (1 NF, 2 NF, 3 NF, BCNF). 5.3 Denormalization: Process, benefits and draw back.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of Database and Architectu	08	04	04	04	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
II	Data models and database types	06	02	04	06	12
III	Database Design using ER model	12	02	04	08	14
IV	Relational Database Model	12	02	06	10	18
V	Normalization	10	02	04	08	14
Total		**48**	**12**	**22**	**36**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Prepare journal of Practicals.
b. Undertake micro-projects.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b. ***'L' in item No. 4*** does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About ***15-20% of the topics/sub-topics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
e. Guide student(s) in undertaking micro-projects.
f. Demonstrate students thoroughly before they start doing the practice.
g. Encourage students to refer different websites to have deeper understanding of the subject.
h. Observe continuously and monitor the performance of students in Lab.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

a. Represent an identified data base in hierarchical model, network model and relational model.
b. Create a Database for Students' formative assessment system, add sample data and perform queries on it using GUI tool.
c. Create database to keep employees' record of an organization. Normalize it up to third normal form.
d. Develop database for employee's payroll system of an organization. Add sample data and perform queries on it using GUI tool.
e. Create database to keep records of product orders, purchase & sales details in Sales Department, add sample data and perform queries on it using GUI tool.
(Use Database concepts and E-R diagram approach to design above listed systems)

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Database Management Systems	Gupta, G. K.	McGraw Hill Education, New Delhi 2013, ISBN: 978-07-107273-1
2	An Introduction to Database Systems	Date, C. J.	Addison Wesley, New Delhi 2003 ISBN 13: 9780321189561
3	Database System Concepts-6e	Silberschatz Abraham, Korth Henry, Sudarshan S.	McGraw Hill Education, New Delhi 2013, ISBN: 978-93-329-0138-4
4	Database Management System- A practical approach	Chopra, Rajiv	S. Chand and Company, New Delhi 2016, ISBN:978-93-856-7634-5

14. SUGGESTED SOFTWARE/LEARNING WEBSITES

a. www.webopedia.com
b. https://www.tutorialspoint.com/database_tutorials.htm
c. www.studytonight.com/dbms/overview-of-dbms.php
d. www.beginnersbook.com/2015/04/dbms-tutorial/
e. www.w3schools.in/dbms/
f. www.tutorialspoint.com/listtutorials/ms-access/1
g. http://www.quackit.com/microsoft_access/tutorial/
h. https://www.techonthenet.com/access/tutorials/