I. INTRODUCTION

A. An introduction to database theory and the practical applications of a database.

B. Topics in this entry-level course include database terminology, database creation, running queries, and database normalization.

C. This course serves as a required or elective course on various degree plans. Curriculum plans for degrees and certificates are listed in the current Central Texas College catalog.

D. The delivery method of this course may be traditional lecture/lab, blended lecture/lab, or online.

E. Prerequisites: ITSE 1329 Programming Logic and Design.

II. LEARNING OUTCOMES

Upon successful completion of this course, Introduction to Database, the student will be able to:

A. Identify database terminology and concepts. (C3, C5, C6, C7, C8, C15, C17, C18, C19, C20, F8, F9, F12).

B. Plan, define, and design a database. (C3, C5, C6, C8, C15, C17, C18, C19, C20, F8, F9, F12).

C. Design and generate tables, forms, and reports. (C1, C5, C6, C8, C19, C20, F1, F3, F8, F9, F12).

D. Devise and process queries. (C1, C5, C6, C8, C19, C20, F1, F3, F8, F9, F12).

E. Create databases for use on Web. (C1, C5, C6, C7, C8, C15, C17, C18, C19, C20, F1, F3, F7, F8, F9, F12).

F. Analyze tables & customize use with macros. (C3, C5, C8, C15, C16, C17, C18, C19, C20, F1, F3, F7, F8, F9, F12).

G. Construct a normalized database (C3, C5, C8, C15, C16, C17, C18, C19, C20)
III. INSTRUCTIONAL MATERIALS

A. The instructional materials identified for this course are viewable through www.ctcd.edu/books

B. Lecture Classes also require at least one USB storage device. Online students may use cloud based storage.

IV. COURSE REQUIREMENTS

A. Attend both lecture and lab or in the case of online delivery, be actively engaged in Blackboard and maintain constant progress.

B. Be prepared to participate in discussion, team projects/assignments and take unannounced assessments relating to the lecture materials.

C. Complete all exams/assessments.

D. Submit all assignments on time.

V. ASSESSMENTS

A. Student content mastery will be evaluated in the following areas:
   • Assessments (midterm exam, quizzes, projects, discussion etc.)
   • Final Assessment (final exam and/or semester project, participation)

B. Scheduled and unscheduled assessments will be given at the discretion of the instructor.

C. Exams/assessments may be composed of both subjective and objective questions plus computer output.

D. A student must take all exams/assessments. Both online and on campus students who know in advance that they will be absent due to school sponsored trips, military duty or orders, or any other valid reason, must arrange to take an early exam/assessment. Unexpected absences due to illness or other extenuating circumstances will require the student to contact the instructor about make-up work in lieu of the missed exam/assessment.

E. Students with unexcused absences will be given a zero for each missed assignment.
VI. SEMESTER GRADE COMPUTATIONS

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<th>Course Requirements</th>
<th>Points</th>
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<tr>
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<th>Grade</th>
<th>Quality Points</th>
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<tr>
<td>900-1000</td>
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<tr>
<td>800-899</td>
<td>B-Above Average</td>
<td>3</td>
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<tr>
<td>700-799</td>
<td>C-Average</td>
<td>2</td>
</tr>
<tr>
<td>600 - 699</td>
<td>D - Passing but Unsatisfactory</td>
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</tr>
<tr>
<td>0 - 599</td>
<td>F-Failure</td>
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VII. NOTES AND ADDITIONAL INSTRUCTIONS FROM THE INSTRUCTOR

A. Course Withdrawal: It is the student’s responsibility to officially withdraw from a course if circumstances prevent attendance. Any student who desires to, or must, officially withdraw from a course after the first scheduled class meeting must file a Central Texas College Application for Withdrawal (CTC Form 59). The student must sign the withdrawal form.

CTC Form 59 will be accepted at any time prior to Friday of the 12th week of classes during the 16-week fall and spring semesters. The deadline for sessions of other lengths is:

- 10-week session: Friday of the 8th week
- 8-week session: Friday of the 6th week
- 5-week session: Friday of the 4th week

The equivalent date (75% of the semester) will be used for sessions of other lengths. The specific last day to withdraw is published each semester in the Schedule Bulletin.

For non-GoArmyEd active military students, the effective date of withdrawal is the filing date with the Education Center. For all other students, the effective date of withdrawal is the date that the withdrawal application is received by the Central Texas College representative.

Students who used financial aid, military tuition assistance, VA benefits, or other non-personal funds may be required to repay tuition and fees to the funding agency. For specific repayment requirements, contact the Office of Student Financial Aid or Veterans Services Office before withdrawing. Military tuition assistance students should visit their military Education Center or Navy College Office.

A student who officially withdraws will be awarded the grade of “W” provided the student’s attendance and academic performance are satisfactory at the time of official withdrawal. Students must file a withdrawal application with the College before they may be considered for withdrawal.
A student may not withdraw from a class for which the instructor has previously issued a grade of “F,” “FI,” “FN,” “IP,” or “XN.”

B. Instructor Initiated Withdrawals: Faculty are authorized to withdraw students who are not making satisfactory course progress to include failure to meet College attendance requirements as outlined in the section of the Catalog entitled “Satisfactory Progress Standards.” The instructor will assign the appropriate grade on CTC Form 59 for submission to the registrar.

Students enrolled in distance learning courses are expected to maintain constant progress throughout the course. Failure to do so may result in the student being administratively withdrawn by the instructor.

Students who have not attended class by the 12th class day of a 16-week course or the 6th class day of an 8-week term may be administratively withdrawn by the instructor with a grade of "W." Students may also be administratively withdrawn from any class when their absences exceed a total of four class meetings for a 16-week course or three class meetings for less than 16-week courses and; in the opinion of the instructor, the student cannot satisfactorily complete the course. In a distance learning course the last date of attendance is the last activity by the student in the course.

C. Administrative Withdrawal: A student may be administratively withdrawn by a designated member of the administrative staff of the College when the student has been placed on Academic Suspension or Disciplinary Suspension; the student has an outstanding financial obligation owed to the college; or the student registered for a course without the required prerequisite or departmental permission.

The College is under no obligation to refund tuition and fees, or other costs associated with an administrative or instructor initiated withdrawal.

D. Incomplete Grade: The College catalog states, “An incomplete grade may be given in those cases where the student has completed the majority of the coursework but, because of personal illness, death in the immediate family, or military orders, the student is unable to complete the requirements for a course...” Prior approval from the instructor is required before the grade of “IP” for Incomplete is recorded.

E. Cell Phones and Pagers: Students will silence cell phones and mobile devices while in the classroom or lab.

F. Americans with Disabilities Act (ADA): Disability Support Services provide services to students who have appropriate documentation of a disability. Students requiring accommodations for class are responsible for contacting the Office of
Disability Support Services (DSS) located on the central campus. This service is available to all students, regardless of location. Review the website at www.ctcd.edu/disability-support for further information. Reasonable accommodations will be given in accordance with the federal and state laws through the DSS office.

G. **Instructor Discretion**: The instructor reserves the right of final decision in course requirements and may make changes to the course outline and/or assignments as needed.

H. **Civility**: Individuals are expected to be aware of what a constructive educational experience is and be respectful of those participating in a learning environment. Failure to do so can result in disciplinary action up to and including expulsion.

I. **Degree Progression**: Students who receive a grade of “D” are advised not to enroll in the next course for which this course was a prerequisite.

J. **Failing Grade**: The grade of “F” or “FN” will be given for academic failure, non-attendance or scholastic dishonesty.

K. **Scholastic Honesty**: All students are expected to maintain the highest standards of scholastic honesty in the preparation of all course work and during examinations. The college policy on scholastic honesty, including definitions on plagiarism, collusion, and cheating can be found at the following URL: http://online.ctcd.edu/plagiarism.cfm
VIII. COURSE OUTLINE

A. Unit One: Introduce course requirements and objectives, general introduction, basic terminology, advantages and disadvantages of database processing.

1. Learning Outcomes: Upon successful completion of this unit the student will be able to:
   a. Concisely define each of the following key terms: data, database, database management system, data model, information, metadata, enterprise data model, entity, relational database, enterprise resource planning (ERP) system, database application, data warehouse, data independence, repository, user view, enterprise data modeling, systems development life cycle (SDLC), prototyping, agile software development, data modeling and design tools, conceptual schema, logical schema, and physical schema.
   b. Name several limitations of conventional file processing systems.
   c. Explain at least 10 advantages of the database approach, compared to traditional file processing.
   d. Identify several costs and risks of the database approach.
   e. List and briefly describe nine components of a typical database environment.
   f. Identify four categories of applications that use databases and their key characteristics.
   g. Describe the life cycle of a systems development project, with an emphasis on the purpose of database analysis, design, and implementation activities.
   h. Explain the prototyping and agile-development approaches to database and application development.
   i. Explain the roles of individuals who design, implement, use, and administer databases.
   j. Explain the differences among external, conceptual, and internal schemas and the reasons for the three-schema architecture for databases.

2. Learning Activities:
   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. Unit Outline: Follow the sequence of the learning outcomes.

B. Unit Two: Database Analysis

1. Learning Outcomes: Upon successful completion of this unit the student will be able to:
a. Concisely define each of the following key terms: business rule, term, fact, entity-relationship model (e-r model), entity relationship diagram (e-r diagram), entity, entity type, entity instance, strong entity type, weak entity type, identifying owner, identifying relationship, attribute, required attribute, optional attribute, composite attribute, simple attribute, multivalued attribute, derived attribute, identifier, composite identifier, relationship type, relationship instance, associative entity, degree, unary relationship, binary relationship, ternary relationship, cardinality constraint, minimum cardinality, maximum cardinality, and time stamp.

b. State reasons why many system developers and business leaders believe that data modeling is the most important part of the systems development process with a high return on investment.

c. Write good names and definitions for entities, relationships, and attributes.

d. Distinguish unary, binary, and ternary relationships and give a common example of each.

e. Model each of the following constructs in an E-R diagram: composite attribute, multivalued attribute, derived attribute, associative entity, identifying relationship, and minimum and maximum cardinality constraints.

f. Draw an E-R diagram to represent common business situations.

g. Convert a many-to-many relationship to an associative entity type.

h. Model simple time-dependent data using time stamps and relationships in an E-R diagram.

i. Recognize when to use supertype/subtype relationships in data modeling.

j. Use both specialization and generalization as techniques for defining supertype/subtype relationships.

k. Specify both completeness constraints and disjointness constraints in modeling supertype/subtype relationships.

l. Develop a supertype/subtype hierarchy for a realistic business situation.

m. Develop an entity cluster to simplify presentation of an E-R diagram.

n. Explain the major features and data modeling structures of a universal (packaged) data model.

o. Describe the special features of a data modeling project when using a packaged data model.

2. Learning Activities:

   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. Unit Outline: Follow the sequence of the learning outcomes.
3. **Unit Outline**: Follow the sequence of the learning outcomes.

C. **Unit Three**: Logical Database Design and the Relational Model

1. **Learning Outcomes**: Upon successful completion of this unit the student will be able to:
   a. Specify SQL object naming rules and conventions.
   b. Concisely define each of the following key terms: relation, primary key, composite key, foreign key, null, entity integrity rule, referential integrity constraint, well-structured relation, anomaly, surrogate primary key, recursive foreign key, normalization, normal form, functional dependency, determinant, candidate key, first normal form, second normal form, partial functional dependency, third normal form, transitive dependency, synonyms, alias, homonym, and enterprise key.
   c. List five properties of relations.
   d. State two essential properties of a candidate key.
   e. Give a concise definition of each of the following: first normal form, second normal form, and third normal form.
   f. Briefly describe four problems that may arise when merging relations.
   g. Transform an E-R (or EER) diagram into a logically equivalent set of relations.
   h. Create relational tables that incorporate entity integrity and referential integrity constraints.
   i. Use normalization to decompose a relation with anomalies into well-structured relations.

2. **Learning Activities**:
   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. **Unit Outline**: Follow the sequence of the learning outcomes.

D. **Unit Four**: Physical Database Design and Performance.

1. **Learning Outcomes**: Upon successful completion of this unit the student will be able to:
   a. Concisely define each of the following key terms: field, data type, denormalization, horizontal partitioning, vertical partitioning, physical file, tablespace, extent, file organization, sequential file organization, indexed file
organization, index, secondary key, join index, hashed file organization, hashing algorithm, pointer, and hash index table.
b. Describe the physical database design process, its objectives, and its deliverables.
c. Choose storage formats for attributes from a logical data model.
d. Select an appropriate file organization by balancing various important design factors.
e. Describe three important types of file organization.
f. Describe the purpose of indexes and the important considerations in selecting attributes to be indexed.
g. Translate a relational data model into efficient database structures, including knowing when and how to denormalize the logical data model.
h. Introduction to SQL Code

2. Learning Activities:
a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
b. Student reading assignments on each topic. (C5, F1, F11)
c. Student participation in discussion of each topic. (C7, F6)
d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. Unit Outline: Follow the sequence of the learning outcomes.

E. Unit Five: Introduction to SQL

1. Learning Outcomes: Upon successful completion of this unit the student will be able to:
   a. Concisely define each of the following key terms: relational DbMs (rDbMs), catalog, schema, data definition language (DDL), data manipulation language (DML), data control language (DcL), scalar aggregate, vector aggregate, base table, virtual table, dynamic view, and materialized view.
b. Interpret the history and role of SQL in database development.
c. Define a database using the SQL data definition language.
d. Write single-table queries using SQL commands.
e. Establish referential integrity using SQL.
f. Discuss the SQL:1999 and SQL:2011 standards.

2. Learning Activities:
a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
b. Student reading assignments on each topic. (C5, F1, F11)
c. Student participation in discussion of each topic. (C7, F6)
d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)
3. **Unit Outline:** Follow the sequence of the learning outcomes.

F. **Unit Six:** Advanced SQL.

1. **Learning Outcomes:** Upon successful completion of this unit the student will be able to:
   a. Embed T-SQL statements inside scripts and batches.
   b. Concisely define each of the following key terms: relational DbMs (rDbMs), catalog, schema, data definition language (DDL), data manipulation language (DML), data control language (DcL), scalar aggregate, vector aggregate, base table, virtual table, dynamic view, and materialized view.
   c. Interpret the history and role of SQL in database development.
   d. Define a database using the SQL data definition language.
   e. Write single-table queries using SQL commands.
   f. Establish referential integrity using SQL.
   g. Discuss the SQL:1999 and SQL:2011 standards.

2. **Learning Activities:**
   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. **Unit Outline:** Follow the sequence of the learning outcomes.

G. **Unit Seven:** Data Quality and integration.

1. **Learning Outcomes:** Upon successful completion of this unit the student will be able to:
   a. Verify First Normal Form.
   b. Concisely define each of the following key terms: data governance, data steward, chief data officer (cDO), master data management (MDM), changed data capture (cDc), data federation, static extract, incremental extract, data scrubbing, refresh mode, update mode, data transformation, selection, joining, and aggregation.
   c. Describe the importance of data governance and identify key goals of a data governance program.
   d. Describe the importance of data quality and list several measures to improve quality.
   e. Define the characteristics of quality data.
   f. Describe the reasons for poor-quality data in organizations.
g. Describe a program for improving data quality in organizations, including data stewardship.

h. Describe the purpose and role of master data management.

i. Describe the three types of data integration approaches.

j. Describe the four steps and activities of the Extract, Transform, and Load (ETL) process for data integration for a data warehouse.

k. Explain the various forms of data transformations needed to prepare data for a data warehouse.

2. Learning Activities:
   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. Unit Outline: Follow the sequence of the learning outcomes.

H. Unit Eight: Data and Database Administration.

1. Learning Outcomes: Upon successful completion of this unit the student will be able to:
   a. Concisely define each of the following key terms: data administration, database administration, open source DbMs, database security, authorization rules, user-defined procedures, encryption, smart card, database recovery, backup facilities, journalizing facilities, transaction, transaction log, database change log, before image, after image, checkpoint facility, recovery manager, restore/rerun, transaction boundaries, backward recovery (rollback), forward recovery (rollforward), aborted transaction, database destruction, concurrency control, inconsistent read problem, locking, locking level (lock granularity), shared lock (s lock, or read lock), exclusive lock (X lock, or write lock), deadlock, deadlock prevention, two-phase locking protocol, deadlock resolution, versioning, data dictionary, system catalog, information repository, data archiving, and heartbeat query.
   b. List several major functions of data administration and of database administration.
   c. Describe the changing roles of the data administrator and database administrator in the current business environment.
   d. Describe the role of data dictionaries and information repositories and how they are used by data administration.
   e. Compare the optimistic and pessimistic systems of concurrency control.
   f. Describe the problem of database security and list five techniques that are used to enhance security.
   g. Understand the role of databases in Sarbanes-Oxley compliance.
h. Describe the problem of database recovery and list four basic facilities that are included with a DBMS to recover databases.

i. Describe the problem of tuning a database to achieve better performance, and list five areas where changes may be made when tuning a database.

j. Describe the importance of data availability and list several measures to improve availability.

2. Learning Activities:
   a. Instructor will conduct classroom lecture/discussion on the topics listed above. (C5, F5, F11)
   b. Student reading assignments on each topic. (C5, F1, F11)
   c. Student participation in discussion of each topic. (C7, F6)
   d. Student will complete assigned laboratory hands-on exercises assigned from software applications textbook(s). (C8, C19, F9)

3. Unit Outline: Follow the sequence of the learning outcomes.