

Online Examination System – Documentation

Type: Technical Documentation

Tech Stack: SQL Server · Windows Forms (.NET) · Power BI

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1. Overview

The **Online Examination System (OES)** is a complete digital examination platform that supports:

- Exam creation and management
- Student exam execution
- Automatic correction
- Performance analytics using Power BI

The system is designed for **real academic environments**, not just academic demos.

2. System Architecture

2.1 Architecture Layers

- **Database Layer** → SQL Server (`Online_examination_system`)
- **Application Layer** → Windows Forms (.NET)
- **Analytics Layer** → Power BI

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[Windows Forms App]
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```
[SQL Server Database]
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[Power BI Dashboards]
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3. Database Design

3.1 Design Principles

- Fully normalized schema (3NF)
 - Junction tables for M:N relationships
 - Strong referential integrity
 - Real-world constraints and checks
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4. Database Mapping

4.1 Academic Structure Mapping

Branch → Department

- Relationship: One-to-Many
- Branch.BranchID → Department.BranchID

Department → Student

- Relationship: One-to-Many
- Department.DepartmentID → Student.DepartmentID

Department ↔ Course

- Relationship: Many-to-Many
- Junction Table: Department_Course

Instructor ↔ Department

- Relationship: Many-to-Many
- Junction Table: Instructor_Department

Instructor ↔ Course

- Relationship: Many-to-Many
 - Junction Table: Instructor_Course
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4.2 Examination Mapping

Course → Exam

- Relationship: One-to-Many

- Course.CourseID → Exam.CourseID

Exam ↔ QuestionBank

- Relationship: Many-to-Many
- Junction Table: Exam_QuestionBank

QuestionBank → Choice

- Relationship: One-to-Many
- QuestionBank.QuestionID → Choice.QuestionID

Student ↔ Exam

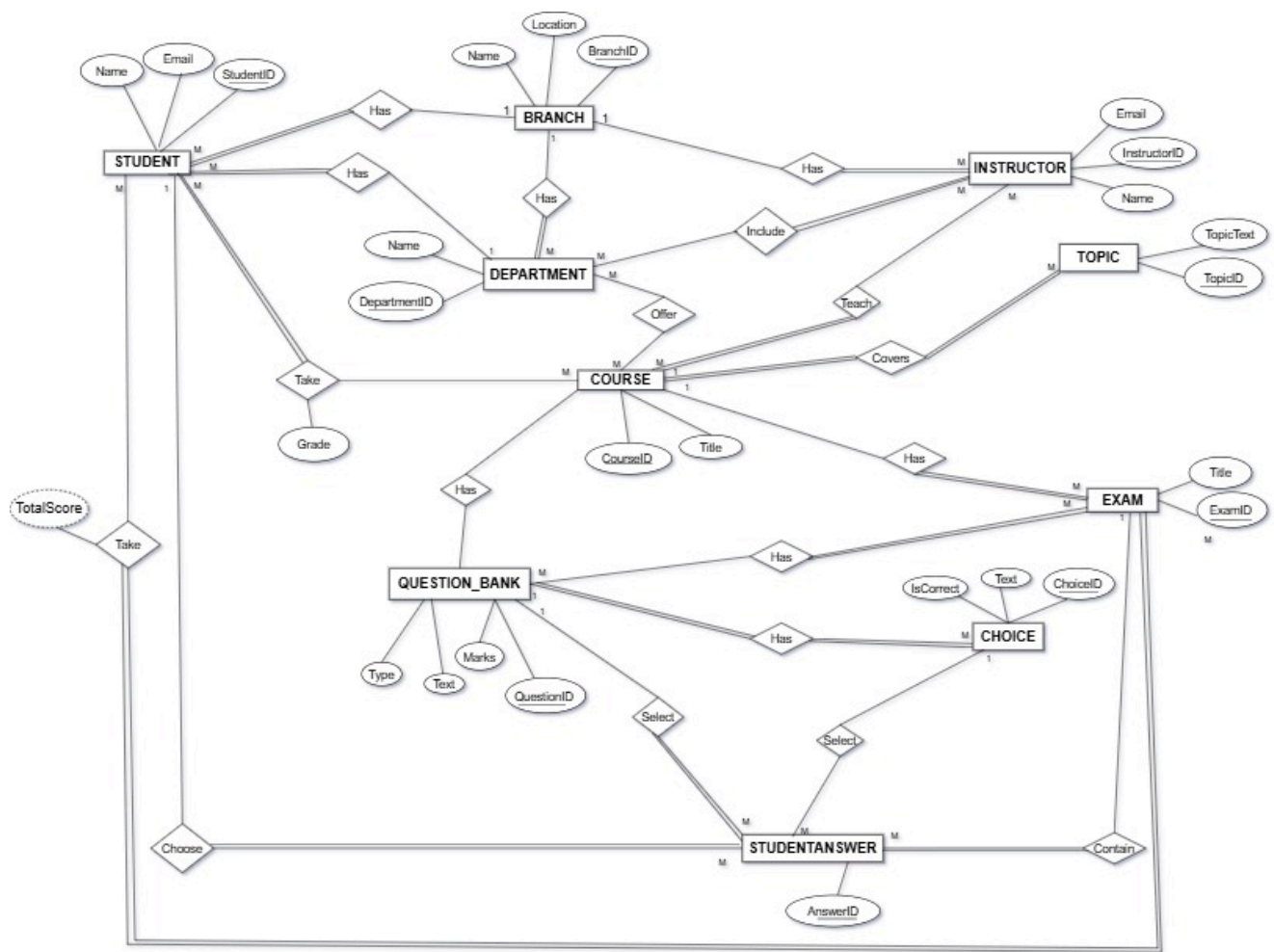
- Relationship: Many-to-Many
- Junction Table: Student_Exam

Student → Student_Answer

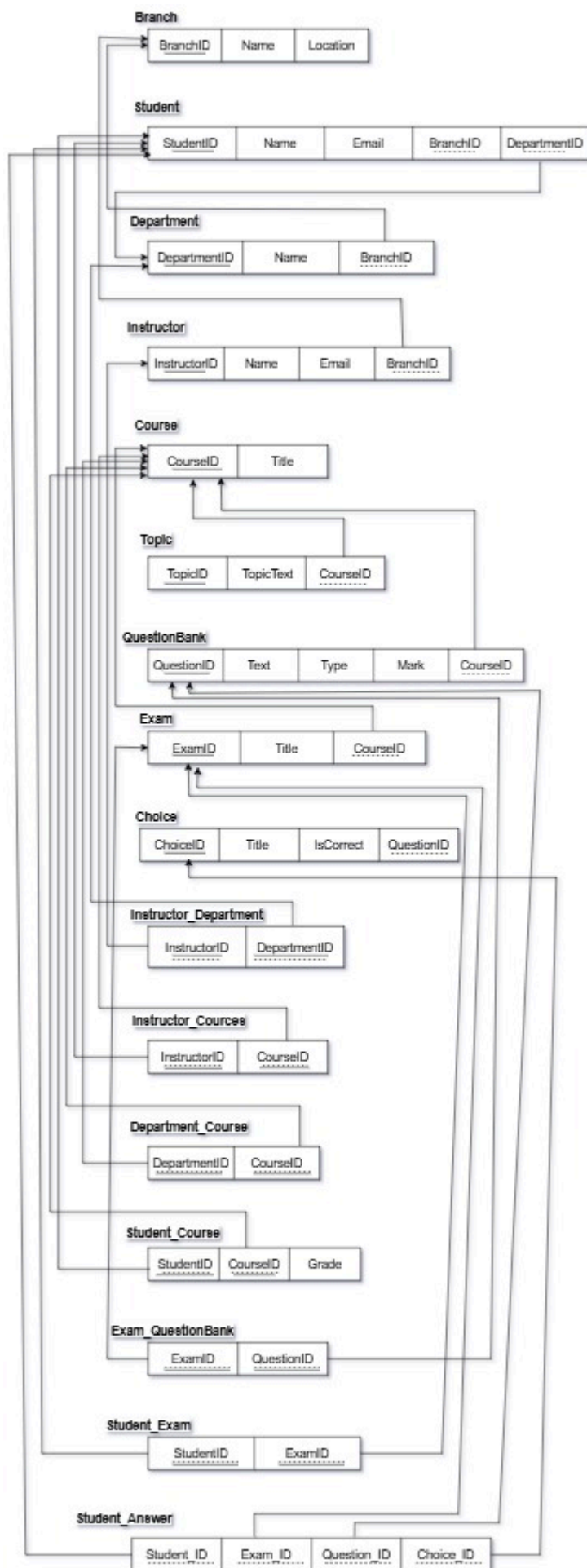
- Relationship: One-to-Many
-

5. Entity Relationship Diagram (ERD)

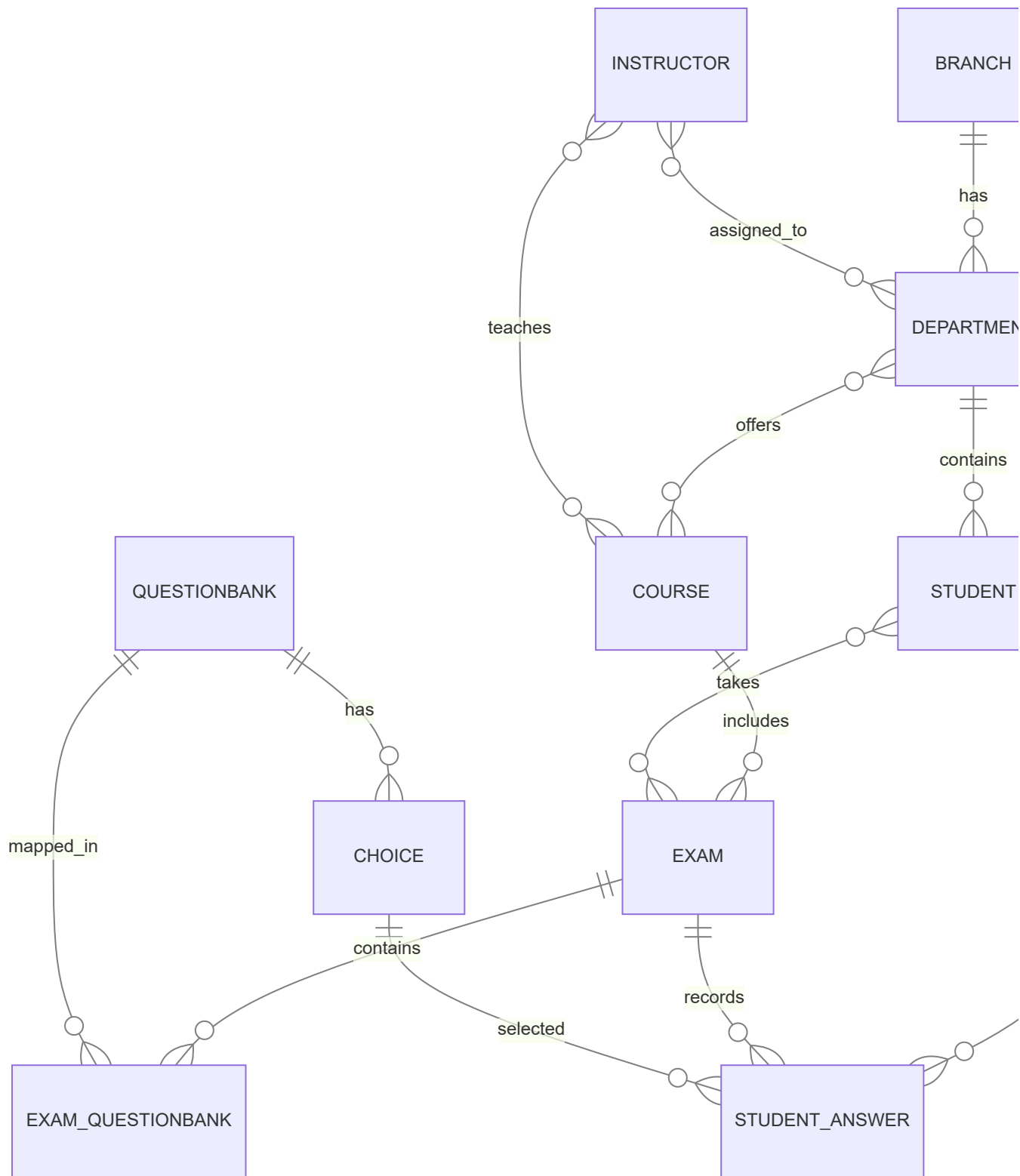
5.1 ERD Image



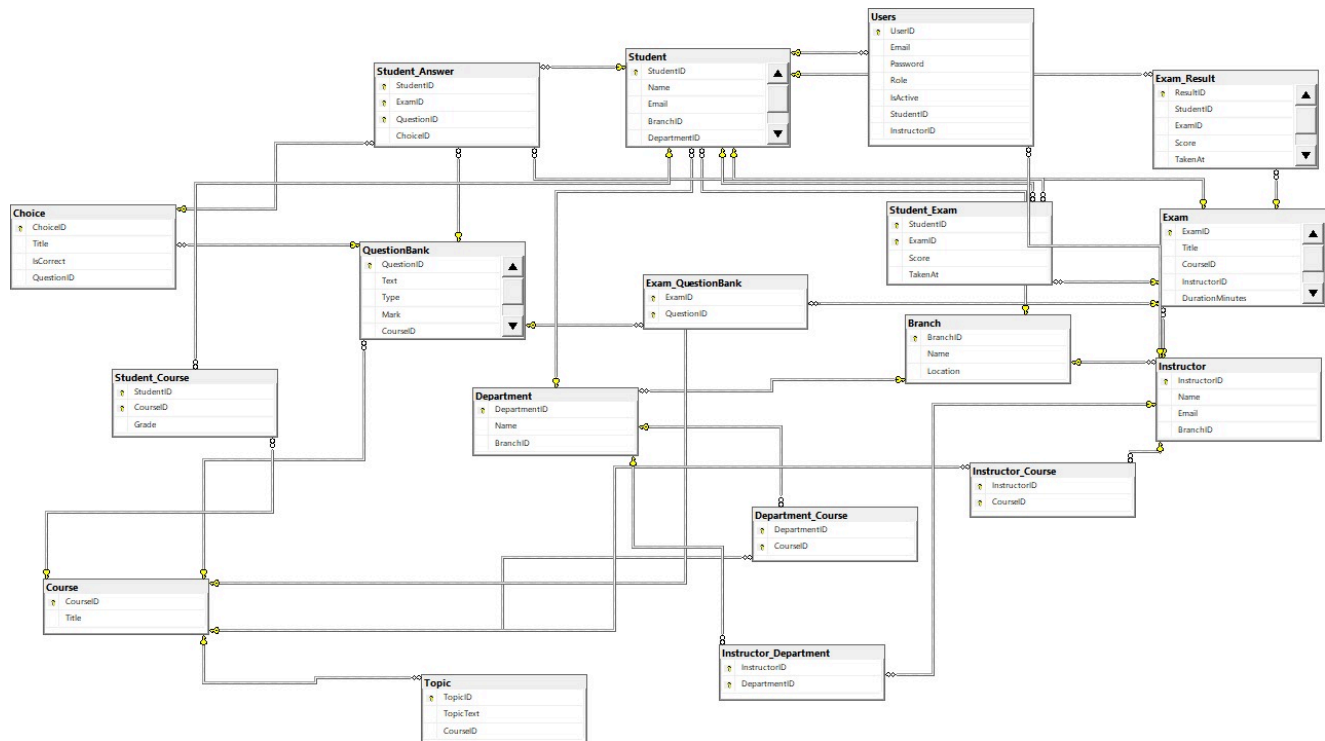
5.2 Mapping Diagram Image



5.3 Mermaid ERD (Logical Diagram)



5.4 ERD IN Data Base



6. Core Entities

Branch

Stores branch information.

- BranchID (PK)
- Name
- Location

Department

- DepartmentID (PK)
- Name
- BranchID (FK)

Course

- CourseID (PK)
- Title

Instructor

- InstructorID (PK)
- Name
- Email (Unique)

- BranchID (FK)

Student

- StudentID (PK)
 - Name
 - Email (Unique)
 - BranchID (FK)
 - DepartmentID (FK)
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7. Examination Module

Exam

Defines exam metadata.

- ExamID (PK)
- Title
- CourseID (FK)
- InstructorID (FK)
- DurationMinutes

QuestionBank

Reusable questions.

- QuestionID (PK)
- Text
- Type (MCQ | TF)
- Mark
- CourseID (FK)

Choice

Possible answers.

- ChoiceID (PK)
 - Title
 - IsCorrect
 - QuestionID (FK)
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8. Relationship Tables (Junctions)

- Instructor_Course
- Instructor_Department
- Department_Course
- Student_Course
- Exam_QuestionBank

These tables ensure **scalability and flexibility**.

9. Exam Execution Flow

Student_Exam

Tracks exam attempts.

- StudentID (PK)
- ExamID (PK)
- Score
- TakenAt

Student_Answer

Stores each student answer.

- StudentID (PK)
 - ExamID (PK)
 - QuestionID (PK)
 - ChoiceID (FK)
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10. Automatic Exam Correction

Correction Logic

1. Retrieve student answers
 2. Compare `ChoiceID` with `IsCorrect = 1`
 3. Sum marks for correct answers
 4. Save results in:
 - Student_Exam
 - Exam_Result
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11. Power BI Integration

Data Model

Fact tables (derived from reports using stored procedures):

- Student_Answers
- Student_Grades
- Instructor_Course_Students

Dimensions:

- Student
 - Course
 - Exam
 - Department
 - Instructor
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Dashboards

- Students information by department
 - Student grades across all courses
 - Instructor courses and number of students per course
 - Course topics
 - Exam questions and choices
 - Student answers for a specific exam
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12. Future Enhancements

- Essay questions
 - Web application version
 - Power BI Service publishing
 - AI-based question difficulty analysis
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13. Conclusion

This system is a **production-ready Online Examination Platform**, integrating:

- Strong database design

- Desktop-based execution
- Advanced analytics