

# Online Examination System – Documentation

**Type:** Technical Documentation

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

**Team member :**

Islam Abd Aljawad Ahmed

Ali Mohamed Ali

Passant Gamal Kamal

Maged Elshebeny

Assem Omar Mohamedy

## 1. Overview

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

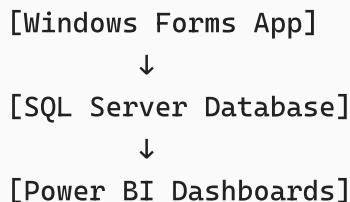
- Exam creation and management
- Student exam execution
- Automatic correction
- Performance analytics using Power BI

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



## 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
- 

## 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
- 

### 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**

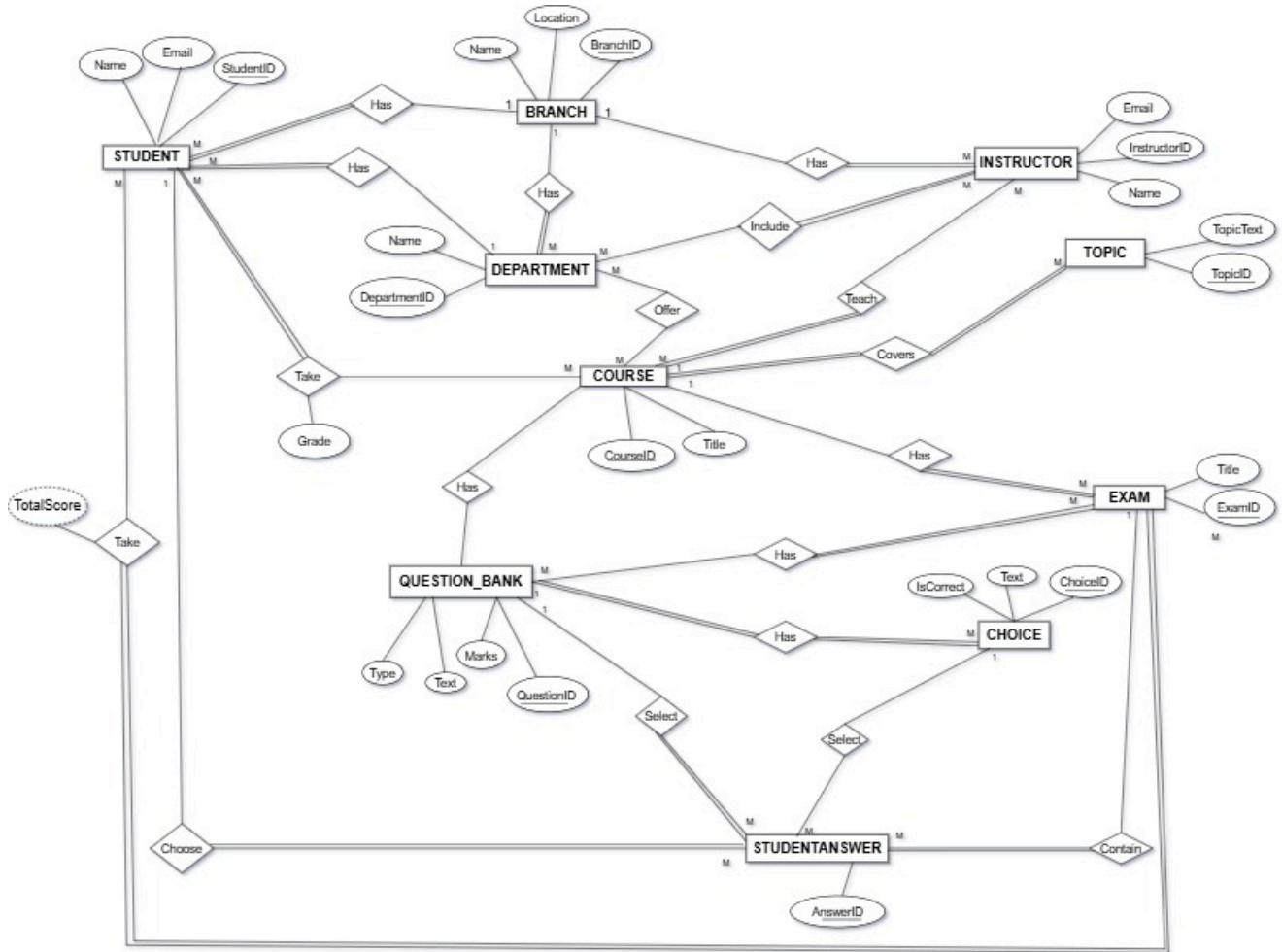
- Relationship: Many-to-Many
- Junction Table: Student\_Exam

### **Student → Student\_Answer**

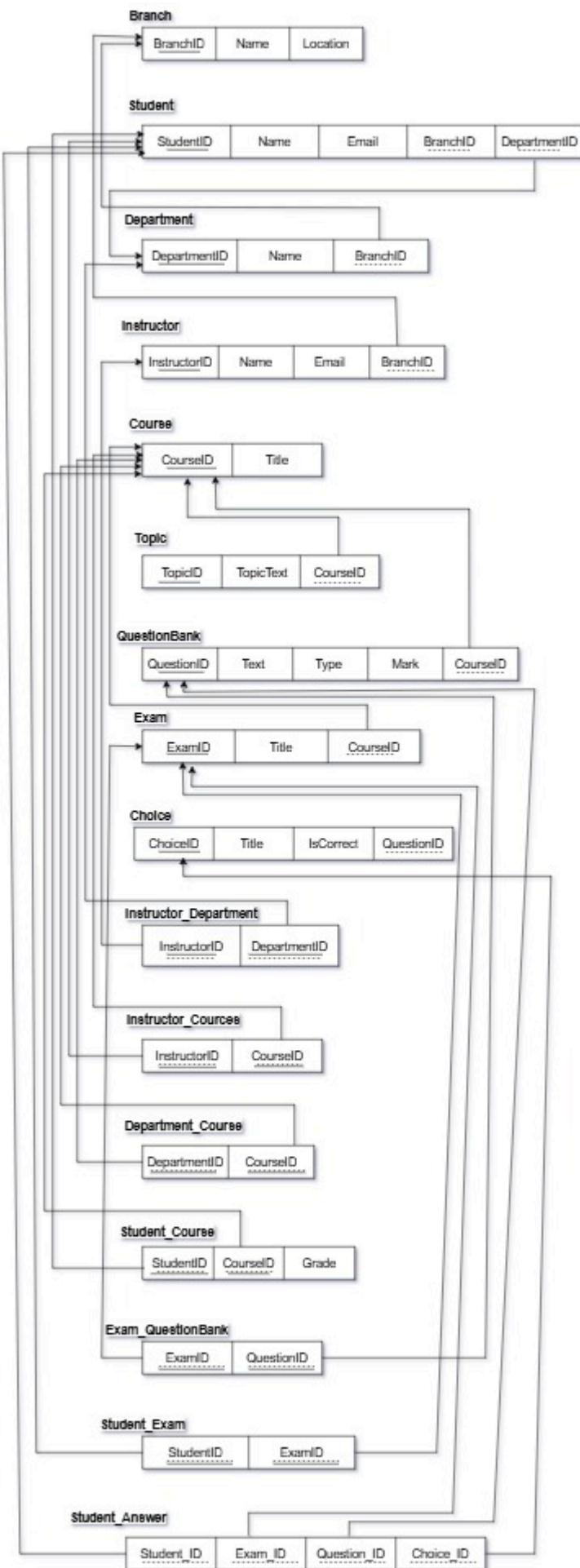
- Relationship: One-to-Many
- 

## **5. Entity Relationship Diagram (ERD)**

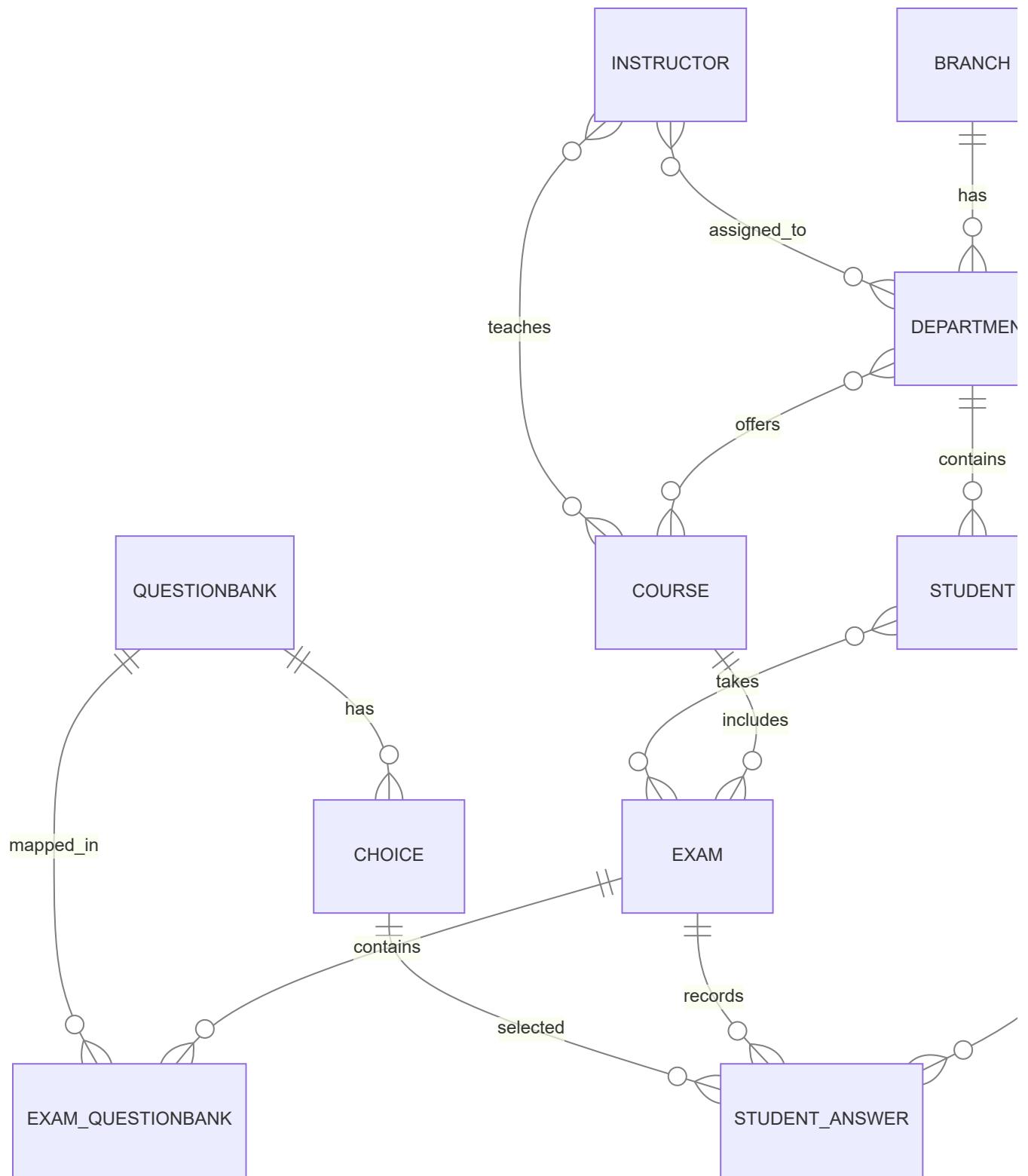
### **5.1 ERD Image**



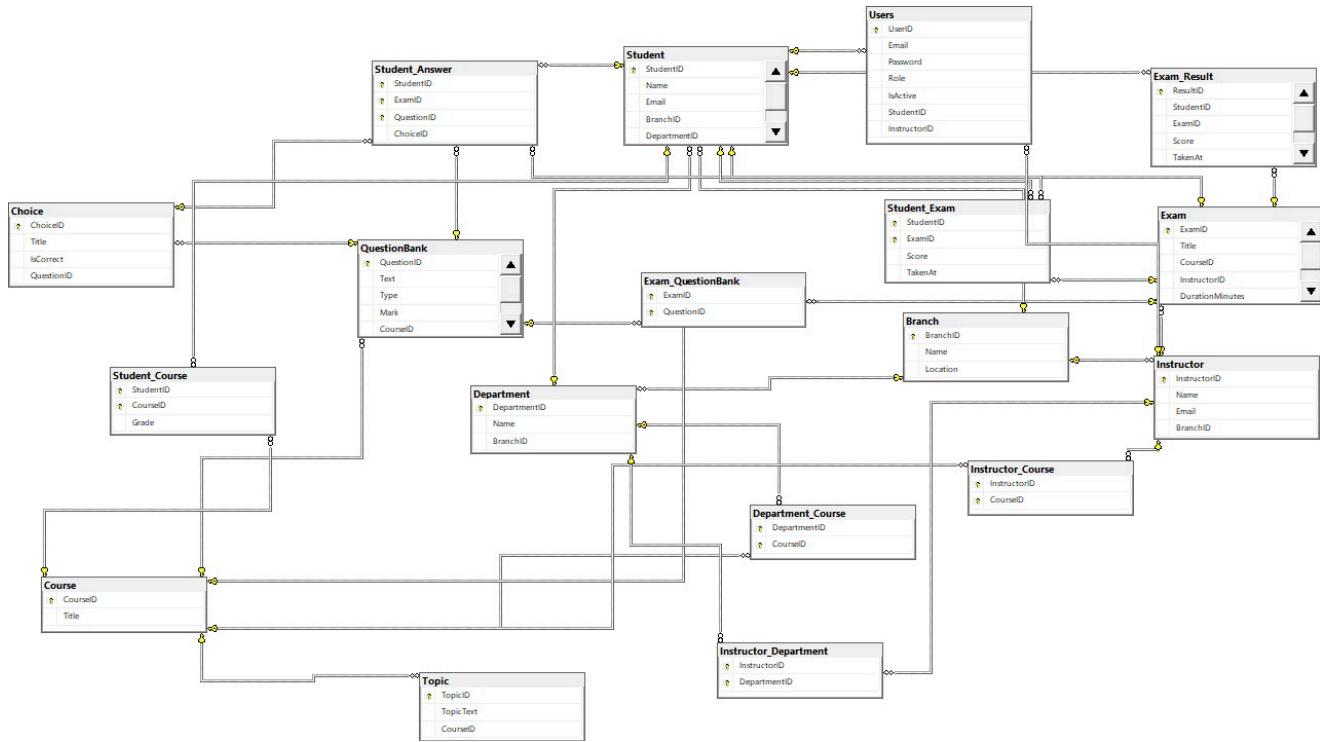
## 5.2 Mapping Diagram Image



## 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)
- 

## 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)
-

## 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)
- 

## 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
-

## 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
- 

### 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
- 

## 12. Future Enhancements

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

## 13. Conclusion

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

- Strong database design

- Desktop-based execution
- Advanced analytics