

**Bangladesh University of Professionals**  
Department of Computer Science and Engineering  
Assignment: Jan-Jun 2025  
Level – 03, Semester - 01  
**Course Code: CSE 3101 | Course Title: Database Management System**  
**Marks – 50**

Central City Hospital needs a new, robust database system to manage its operations. The system must efficiently handle patient information, doctor scheduling, ward allocation, and complex appointment data.

The functional requirements for the new system are as follows:

- 1. **Staff:**
  - **Doctors** (DoctorID, Name, Phone, Salary)
  - **Nurses** (NurseID, Name, Phone, Shift)
- 2. **Departments:** The hospital is divided into multiple
  - **Departments** (DeptID, DeptName, HeadDoctorID).
  - Every doctor works for exactly one department.
- 3. **Patients:** Track basic patient information (PatientID, Name, DOB, Address).
- 4. **Appointments:**
  - Appointments are scheduled for a PatientID with a DoctorID on a specific Date and Time.
  - For each appointment, the Diagnosis and the Fee charged must be recorded.
  - A doctor cannot have two appointments at the exact same Date and Time.
- 5. **Wards and Beds:**
  - The hospital has multiple **Wards** (WardID, WardType).
  - Patients may be admitted to a Bed (BedNo) in a specific WardID on an AdmissionDate.
  - A patient is supervised by one or more **Nurses** during their stay.
- A. **Conceptual Design - Enhanced Entity-Relationship (ER) Diagram (15 Marks)**

Create a comprehensive Entity-Relationship (ER) Diagram for the final Hospital Management System. Your ER Diagram must clearly show:

  - All Entities (e.g., Doctor, Patient, Appointment, Ward etc.).
  - All Attributes for each entity, with Primary Keys clearly identified.
  - All Relationships between Entities.
  - The Cardinality Constraints (Min-Max) for every relationship.
  - The complex relationship between Patients, Wards, and Nurses.
  - Implement specialization and Generalization (Mandatory).

- B. **Logical Design - Relational Schema and Constraints (15 Marks)**

Convert your ER Diagram into a Relational Database Schema.

  - Final Relational Schema (5 Marks): List all the tables (relations) in your final schema. For each table, list all attributes. Clearly denote the Primary Keys and Foreign Keys.
  - Constraint Specification (10 Marks): For the four relations listed below, specify all necessary constraints (Primary Key, Foreign Key, and other relevant constraints like NOT NULL, UNIQUE or CHECK). For Foreign Key constraints, you must also specify and justify the appropriate ON DELETE and ON UPDATE actions.

Relation (Table)	Constraints Required
Doctor	PK, CHECK (for Salary), NOT NULL
Appointment	PK, FK, NOT NULL
Department	PK, FK, NOT NULL
Patient_Admission (Linking Patient, Ward, Bed, Nurse)	PK, FK, NOT NULL

- C. **Analytical Critique and Decomposition (20 Marks)**

Consider the following relation, R used to track appointments, and the Functional Dependencies (FDs) that hold true:

Relation R (DoctorID, Date, Time, DocName, DocSalary, PatientID, PatientName, Diagnosis, Fee)

Functional Dependencies (FDs) holding in R:

  - DoctorID → DocName, DocSalary
  - PatientID → PatientName
  - DoctorID, Date, Time → PatientID, Diagnosis, Fee
  - DoctorID, Date, Time, PatientID → Diagnosis, Fee
  - i. Normalization Violation and Problems (15 Marks):
    - What are the Candidate Keys (CK) of the relation R?
    - Show at least 5 super keys (SK) in R.
  - ii. Decomposition (5 Marks):
    - Decompose the relation R into a set of smaller relations that must be lossless.
    - Show your final decomposed relations with their attributes and Primary Keys.

**Submission Guidelines:**

- Submit a detailed **handwritten** report (**hardcopy and softcopy**) outlining Diagrams (E-R, Relational Schema), and step-by-step calculations.
- Ensure clarity, UNIQUENESS, coherence, and correctness in your solutions.
- Avoid copying, it may result in a **maximum of 10%** marks only.

**Deadline: 15 December 2025, Monday**