0073

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical & Computer Engineering

Study Programme	:	Bachelor of Science Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**EEX3266 - Information Systems and Data Management**
Academic Year	:	2024/25
Date	:	07th March 2026
Time	:	1330-1630h
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of **Five (4)** questions in **Three (3)** pages.
3. Answer **all** questions.
4. Answer for each question should commence from a new page.
5. This is a Closed Book Test (CBT).

Question 01 [25 Marks]

An Online Learning Management System (LMS) is proposed to be developed for use by a large number of students, lecturers, and academic staff of a national higher education institution. The system is required to store and manage data related to students, courses, enrollments, examination results, learning resources (such as documents and video materials), and user activity records.
Initially, the system was intended to serve a limited number of users. However, due to increasing demand, it is now required to support a large user base, high data volume, and scalable access. The development team has decided to apply appropriate database types, follow proper data modelling techniques, ensure data independence, and adopt a structured Database Development Life Cycle in designing the database.

(a) With justification, identify and explain suitable database types that can be used to implement the above system. *(4 marks)*

(b) Explain how data modelling can be applied in designing the database for the LMS. Describe the conceptual, logical, and physical data models with examples relevant to the given scenario (LMS). *(8 marks)*

(c) Discuss the concept of data independence and explain its importance to the LMS. Clearly describe physical data independence and logical data independence using suitable examples. *(6 marks)*

(d) Describe the main stages of the Database Development Life Cycle that should be followed in developing the database system for the LMS. *(7 marks)*

Question 02 [25 Marks]

ABC Airline operates flights to several destinations.
Each flight is uniquely identified by a flight number and date and has a departure time.
Each flight is operated using one aircraft type, and each aircraft type has a fixed seating capacity.

Passengers may travel on flights operated by the airline.
A passenger may travel on multiple flights, and a flight may carry many passengers.

Each seat reserved on a flight is represented by a ticket.
Each ticket corresponds to one seat on one flight and belongs to exactly one passenger.
A passenger may own multiple tickets.

Each ticket has a unique ticket number, seat number, and booking date.

Passengers must make payments for tickets.
Each payment records the payment date, amount, and payment method.
A payment may cover one or more tickets, but each ticket must be paid for by exactly one payment.

(a) Identify all entities, attributes, and primary keys. *(10 marks)*

(b) Identify all relationships, their cardinalities, and any relationship attributes. *(7.5 marks)*

(c) Draw a Chen Entity–Relationship (ER) diagram to represent the system clearly. *(7.5 marks)*

Question 03 [25 Marks]

A mobile phone seller stores information about mobile phones supplied by different brands in the following spreadsheet.

UN-NORMALISED FORM (UNF)

Phone Model	Brand Name	Brand Telephone	Brand Email	Delivery Time	Colors Available
Galaxy A15	Samsung	112345678	info@samsung.com	7 days	black, blue, white
Galaxy S23	Samsung	112345678	info@samsung.com	10 days	black, green
iPhone 14	Apple	118765432	contact@apple.com	2 weeks	silver, black
iPhone 15	Apple	118765432	contact@apple.com	3 weeks	blue, pink

Table 01

a) Identify all attributes, repeating groups, and main entities present in the UNF table. *(5 marks)*

b) Identify the functional dependencies that exist in the given data. *(5 marks)*

c) Convert the given UNF table into First Normal Form (1NF). Clearly show the resulting table(s) and identify the primary key(s). *(5 marks)*

d) Convert the 1NF relations into Second Normal Form (2NF) by removing any partial dependencies. Clearly identify all primary keys (PK) and foreign keys (FK). *(7 marks)*

e) Convert the relations into Third Normal Form (3NF). Explain whether any transitive dependencies exist and justify your answer. *(2 marks)*

f) Explain one advantage of normalising the database up to Third Normal Form in this scenario. *(1 mark)*

Question 04 [25 Marks]

The City Traffic Authority wants to track all traffic accidents in the city.
They maintain accident participation data in a single table with the following structure and sample data.

Accident Information

Accident ID	Accident Date	Location	Person Name	Model	Number Plate	Damage Amount (LKR)
1001	1/10/2026	Main Street	Namal Perera	Toyota Camry	WP NA 1010	150,000
1001	1/10/2026	Main Street	Kavindi Fernando	Honda Civic	WP NB 2020	200,000
1002	1/15/2026	2nd Avenue	Namal Perera	Toyota Camry	WP NA 1010	50,000
1002	1/15/2026	2nd Avenue	Chathura Silva	Ford Focus	CP AC 3030	120,000
1003	1/20/2026	3rd Avenue	Kavindi Fernando	Honda Civic	WP NB 2020	80,000
1004	1/22/2026	4th Street	Namal Perera	Tesla Model 3	WP NC 4040	250,000

Table 02

Assume that the database system supports standard SQL. Based on the above table answer the following questions.

(a) Create the table using SQL with appropriate data types. *(5 marks)*

(b) Insert the first two rows of the above data into the table. *(4 marks)*

(c) Write an SQL statement to change the car number plate CP AC 3030 to WP AC 3030. *(2 marks)*

(d) The column name PersonName is incorrect. Rename the column to DriverName. *(2 marks)*

(e) List all accidents along with the cars and drivers involved. *(2 marks)*

(f) Count the number of accidents for each car. *(3 marks)*

(g) Find the drivers who have been involved in more than one accident. *(3 marks)*

(h) Find the car that has the highest total damage. *(3 marks)*

(i) List all accidents that occurred in January 2026. *(1 mark)*