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Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Final Examination, Fall 2025

Course Code: CSE227, Course Title: System Analysis and Design

Level: 2, Term: 2, Batch: 66

Time: 02:00 Hrs **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

You have been assigned to develop a **Fitness Center Automation System** for a 3-branch fitness club that runs in Dhaka, Chattogram and Sylhet. The centers are open from 6 am to 11 pm and provide services such as **gym workouts, personal training, group fitness classes and nutrition consultations**. The system must handle three membership plans: **Regular (Tk. 2,500/month), Premium (Tk. 4,500/month), and Elite (Tk. 7,000/month)**—along with a mandatory **registration fee of Tk. 3,000**. **Optional services** include **personal training (Tk. 1,500 per session)** and **nutrition consultations (Tk. 800)** for non-Elite members, while **Elite members** receive **nutrition consultations** for **free**. For security, **passwords** must follow **strict strength rules**, login is restricted to **one device at a time**, and **changing devices needs OTP verification**. Members are able to schedule group classes with limited seats; (Yoga, HIIT, Cardio Dance), and the system must track attendance and generate class occupancy reports. Entry to the fitness center is controlled using a **QR-code digital pass**, which becomes inactive if payment is overdue. Members are also required to complete a health declaration form upon registration so that the system could recommend appropriate exercises according to medical constraints or health conditions.

Your task is to design a system that efficiently manages memberships, payments, scheduling, attendance, health data, and secure access control across all branches while ensuring a smooth user experience

Now answer the following questions

1.	a.	Explain how the Fitness Center can use digital marketing channels (email, social media, SMS, app notifications) to promote upcoming classes and boost member engagement.	[5]	CO1
	b.	The system processes online payments for memberships and training fees. Compare three electronic payment systems and argue which is most suitable for this fitness center.	[3]	CO1

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2.	a.	Design a Monthly Payment Invoice for the members. It may include Invoice Number, Member Details, Base Membership Fee, Registration Fee (if applicable), Optional Services (PT Sessions, Nutrition Consultations), Discount (if any), Total Payable Amount, Payment Status (Paid/Unpaid), Due Date, Payment Gateway Reference ID.	[5]	CO2
	b.	Create test cases and test data required to evaluate the functionality of the QR-code–based login/access system.	[7]	CO2
	c.	Analyze the system and outline a security and access control strategy that protects member information and prevents unauthorized access to facilities.	[5]	CO2
3.		The following table shows the time and dependency of the different activities to complete the system. Based on this		CO3
		I. Draw the complete PERT diagram showing all dependencies. Do not skip nodes, label all activity and arrows clearly.	[4]	
		II. Show forward and backward calculation and determine the Early Start (ES), Early Finish (EF), Late Start (LS) and Late Finish (LF) of all activities.	[4]	
		III. Using your calculations, determine the complete Critical Path and the total project duration.	[2]	
		IV. The client unexpectedly requests a change that adds 3 extra weeks to Activity, E Evaluate its impact on the Critical path, Total project duration, Slack distribution of affected tasks, whether project delay is avoidable or not (Show calculation and reasoning.)	[5]	

Activity	Dependency	Duration
A	---	5
B	A	7
C	----	4
D	A.C	6
E	B	4
F	C	5
G	D,E	4
H	D,F	8
I	G,H	6
J	E,F	7
K	I,J	5