PMG 4101 – Mid-Term Exam (Fall 2024)

Course Title: Project Management

Total Marks: 30 Duration: 1 hour 30 minutes

1. Methodology Choice & Drawbacks of SCRUM [CO1]

For this evolving, feature-rich project, the best-fit software engineering methodology is Agile, specifically an Incremental Iterative approach.

Why Agile?
- Pilot needed in 4 months – Agile supports early delivery
- Evolving requirements – Agile handles changes easily
- Frequent collaboration with teachers/students
- Supports incremental feature addition

Drawbacks of SCRUM:
- Assumes a cross-functional team – current team lacks AI/UX
- Daily standups can feel burdensome
- Risk of scope creep
- Relies heavily on clear backlog and Product Owner

2. Vision and Scope Document [CO2]

Vision Statement:
To create a smart, AI-powered e-learning platform that adapts to each student's pace, boosts engagement through gamification, and fosters real-time collaborative learning.

Scope Summary:
In Scope:
- AI-driven personalization
- Adaptive quizzes with real-time feedback
- Progress tracking and gamification
- Collaboration tools (chat, boards)
- Pilot release in 4 months

Out of Scope (initially):
- Offline mobile support
- VR-based content

Assumptions:
- Experts hired early
- Regular SME feedback

Constraints:
- Tight pilot timeline
- Lack of in-house AI/UX expertise

3. WBS Rules & Development [CO3]

WBS Rules:
- 100% Rule – cover entire project scope
- Tasks should be clear, independent
- Hierarchical breakdown
- Assign owners and durations

Work Breakdown Structure (WBS):
1. Planning Phase
   - 1.1 Requirement Gathering
   - 1.2 Team Recruitment
2. Design Phase
   - 2.1 UI/UX Design (6 days)
   - 2.2 System Architecture
3. Development Phase
   - 3.1 User Management
   - 3.2 Adaptive Quiz (10 days)
   - 3.3 Gamification
   - 3.4 Collaboration Tools
4. Testing Phase
   - 4.1 Unit Testing
   - 4.2 Pilot Testing
5. Deployment
   - 5.1 Cloud Deployment
   - 5.2 Feedback Collection

4. Delphi Wideband Estimation (DWE) [CO3]

Moderator Responsibilities:
- Explain project scope and estimation steps
- Provide available data
- Maintain unbiased, anonymous estimation

Team Members: Developer, UX Designer, AI Specialist

Estimation Example for 'Adaptive Quiz Engine':
Round 1: 8, 12, 15 (Discuss)
Round 2: 10, 11, 12 (Closer)
Round 3: 11, 11, 11 (Converged)

Final Estimate: 11 Days

5. Risk Plan Sheet [CO2]

Risk ID	Description	Likelihood	Impact	Mitigation Strategy
R1	Delay in hiring AI/UX experts	High	High	Start hiring during planning phase
R2	System overload during peak usage	Medium	High	Use scalable cloud infra + testing
R3	Change in client priorities or scope	High	Medium	Use MoSCoW method for feature priorities

1. Work Breakdown Structure (WBS)

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1. Planning Phase

- **1.1 Requirement Gathering & Analysis**
- **1.2 Stakeholder Interviews**
- **1.3 Technical Feasibility Assessment**
- **1.4 Project Timeline & Resource Planning**
- **1.5 Team Recruitment**

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2. Design Phase

- **2.1 UI/UX Design**
    - 2.1.1 Wireframes
    - 2.1.2 High-fidelity Prototypes
    - 2.1.3 Design System (colors, typography, components)
- **2.2 System Architecture**
    - 2.2.1 Database Schema
    - 2.2.2 API Design
    - 2.2.3 Module Architecture (User, Quiz, Gamification, Collab Tools)

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3. Development Phase

- **3.1 User Management Module**
    - 3.1.1 Registration & Login
    - 3.1.2 Role Management
    - 3.1.3 Profile & Preferences
- **3.2 Adaptive Quiz Engine**

    - 3.2.1 Question Bank Management
    - 3.2.2 Difficulty Adaptation Logic
    - 3.2.3 AI-Based Recommendation for Next Questions
    - 3.2.4 Result Analysis & Reports
- **3.3 Gamification Module**
    - 3.3.1 Badges & Levels
    - 3.3.2 Leaderboard
    - 3.3.3 Daily Challenges
- **3.4 Collaboration Tools**
    - 3.4.1 Peer Discussion Forum
    - 3.4.2 Group Activities
    - 3.4.3 Messaging/Notification System

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4. Testing Phase

- **4.1 Unit Testing**
- **4.2 Integration Testing**
- **4.3 Pilot Testing (Real Users)**

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5. Deployment & Post-Launch

- **5.1 Cloud Deployment**
- **5.2 Beta Release**
- **5.3 Feedback Collection & Improvements**

Component A — 2.1 UI/UX Design (unit: days)

WBS Item	Estimated Duration
2.1.1 Wireframes (core flows: student, teacher, quiz)	2 days
2.1.2 High-fidelity prototypes (clickable for pilot)	3 days
2.1.3 Design system & UI components (styles, buttons, forms)	2 days
Total (2.1 UI/UX Design)	**7 days**

Component B — 3.2 Adaptive Quiz Engine (unit: days)

WBS Item	Estimated Duration
3.2.1 Question Bank Management (CRUD, tagging, metadata)	3 days
3.2.2 Difficulty Adaptation Logic (rules, item response scaffolding)	3 days
3.2.3 AI-based Recommendation (model hookup, inference pipeline)	3 days
3.2.4 Result Analysis & Reports (per-student summary, basic analytics)	2 days
Total (3.2 Adaptive Quiz Engine)	**11 days**

2. DELPHI WIDEBAND ESTIMATION (DWE)

Estimator Submissions for WBS Item: Adaptive Quiz Engine

Team Members: Developer, UX Designer, AI Specialist

Round 1 Estimates

Role	Optimistic (O)	Most Likely (M)	Pessimistic (P)
Developer	6	10	14
UX Designer	5	12	18
AI Specialist	8	15	20

Discussion: Large variation because team members have different assumptions about complexity, UI adaptivity, and model integration.

Round 2 Estimates (After Discussion)

Role	Optimistic (O)	Most Likely (M)	Pessimistic (P)
Developer	8	11	14
UX Designer	7	11	15
AI Specialist	9	12	16

Discussion: Differences narrow after clarifying the adaptive logic, UI flow, and needed training data.

Round 3 Estimates (Converging)

Role	Optimistic (O)	Most Likely (M)	Pessimistic (P)
Developer	9	11	13
UX Designer	9	11	13
AI Specialist	9	11	13

Round 3 shows full convergence.

Final PERT Estimate

Using PERT:

$$E = \frac{O + 4M + P}{6}$$

For the converged values:

$$E = \frac{9 + 4(11) + 13}{6} = \frac{9 + 44 + 13}{6} = \frac{66}{6} = 11 \text{ days}$$