Test Case ID	Module	Test Objective	Input / Condition	Expected Output
TC-01	Pattern Recognition Module (PRM)	Verify initial ILS inference from questionnaire	Completed Felder–Soloman ILS form	Correct ILS category (Active–Reflective, Sensing–Intuitive, etc.)
TC-02	PRM	Validate behavioural refinement	Navigation logs, content interactions	Updated ILS weights based on EMA and behavioural patterns
TC-03	PRM	Handle incomplete or noisy logs	Missing timestamps, abrupt session end	System should ignore invalid logs & continue refinement
TC-04	Adaptive Teaching Engine	Validate content selection	User with Visual preference	System delivers diagrams, charts, video-based content
TC-05	Adaptive Teaching Engine	Validate quiz adaptation	Low competency score in Topic A	Easier questions + explanatory hints
TC-06	Adaptive Teaching Engine	Test competency score updates	Quiz score + response time data	Updated competency using formula (EMA + accuracy weighting)
TC-07	RAG Engine	Verify retrieval accuracy	Student query about subject content	$\geq 85\%$ accurate, source-grounded answer
TC-08	RAG Engine	Handle ambiguous queries	Vague question without context	System requests clarification instead of hallucinating
TC-09	RAG Engine	Prevent hallucination	Query outside syllabus	System states "information not available"
TC-10	Multimodal Generator	Measure diagram generation latency	Request "Explain quicksort using diagram"	Diagram generated within ≤ 18.3s (current)
TC-11	Multimodal Generator	Test multimodal accuracy	Diagram request + textual concept	Diagram matches explanation (structure, labels)
TC-12	Dashboard Analytics	Validate performance charts	Student interacts with quizzes	Charts update: accuracy, progress, time distribution
TC-13	Dashboard Analytics	Verify learning pattern graphs	1 week of activity logs	Correct bar/line charts generated
TC-14	System Performance	Test overall response time	Mixed content requests	Response delivered < 5 seconds (text-only)
TC-15	System Performance	Stress test	50 concurrent user sessions	No crash; latency < acceptable limit
TC-16	Security Module	Verify authentication	Login with valid JWT	Access granted
TC-17	Security Module	Test unauthorized access	Invalid or expired JWT	Access denied
TC-18	Security Module	Ensure data encryption	User profile & logs	All data encrypted in-transit & at-rest
TC-19	UI/UX Interface	Check responsiveness	Load on mobile, desktop, tablet	UI adjusts correctly (CSS grid/flex conditions)
TC-20	UI/UX Interface	Check error handling	Incorrect inputs or empty fields	User-friendly error messages displayed