**Title*:*** *Free Management Plan for MANSOL HAB LMS Project*

**1*. Structured Data Management***

* **Data:** Students info (name, email, learner ID, courses, progress, login credentials), Courses info (title, description, duration, fees, entry requirements), Progress & quiz scores, Payment metadata, Notifications metadata
* **Free Solution:** supabase Realtime Database (Spark Plan)
* **Storage Limit:** 1 GB (sufficient for metadata)
* **Notes:** Provides real-time updates, role-based access, and lightweight storage

**2. *Large Files / Media Management***

* **Data:** Course videos, PDFs, slides, student assignments
* **Free Solution:** Google Drive Free (15 GB) / Mega Free (20 GB) / Backblaze B2 Free (10 GB)
* **How It Works:**
* Upload files to cloud storage
* Store file URLs in Firebase DB
* LMS fetches URLs dynamically for students
* **Limitations & Solutions:**
* Free accounts have bandwidth limits; compress videos or split into chunks
* File updates require updating DB URLs

**3. *Emails & Notifications***

* **Data:** Automated emails for registration, payments, assignments, grades, certificate readiness
* **Free Solution:** Gmail SMTP (500 emails/day) / SendGrid Free Tier (100 emails/day)
* **Implementation:** DB stores metadata/triggers; emails sent via SMTP or SendGrid API

**4. *Reports & Analytics***

* **Data:** Student performance reports, course completion stats, exported PDFs
* **Free Solution:** Firebase DB for analytics numbers + Google Drive for PDFs
* **Notes:** Keeps DB lightweight, large reports stored externally

**5*. Real-Time Management***

* **Components Fully Real-Time:**
* Student progress, quiz submissions, course enrollment, dashboards
* Notifications & email triggers
* **Components Partially Real-Time:**
* Large file streaming (depends on bandwidth & cloud storage)
* **Workaround:** Update DB URLs on file updates, compress/optimize media

**6. Implementation Workflow**

* Upload all course materials and assignments to cloud storage
* Store all URLs in Firebase Realtime Database
* Manage student enrollment, progress, quizzes, and payments in Firebase
* Trigger notifications & automated emails using SMTP or SendGrid
* Update DB URLs whenever a large file is updated
* Compress or optimize videos and PDFs to save storage and improve access speed

**Conclusion:**

* The LMS can be fully managed using free services
* Real-time updates work for structured data
* Large files managed externally with URLs in DB
* Automated notifications and reports are possible using free email services
* Total storage needed: ~12 GB, fully achievable with free plans

**Note:** This plan ensures a complete LMS setup for MANSOL HAB using only free tools while maintaining real-time functionality and scalability.