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| **Milestone** | **Focus & Deliverables** |
| **1. Environment & Tooling Foundations***Days 1–3* | • Install Python & create a venv• **Git basics**: git init, clone, commit, branch, merge• **GitHub & GH-CLI**: push/pull repos, PR workflow, issues• **MySQL Workbench**: install, connect, run DDL/DML• **Docker fundamentals**: install, pull images, run containers, write a simple Dockerfile |
| **2. FastAPI Kickoff & Repo Setup***Days 4–5* | • backend/ repo scaffold in GitHub• FastAPI “Hello, world” in main.py• Dockerize that basic app (build image, run container) |
| **3. Database Modeling & CRUD***Week 1–2* | • Learn SQL schema design in MySQL Workbench• Async SQLAlchemy (or SQLModel) + Alembic migrations• Product CRUD endpoints with Pydantic schemas• Spin up MySQL in Docker Compose |
| **4. Authentication & Authorization***Week 3* | • OAuth2 password flow + JWTs• Password hashing (bcrypt)• Role-based access control• Test auth flow locally and in Docker |
| **5. API Documentation & Versioning***Week 4* | • Customize OpenAPI (tags, descriptions)• Versioned routes (/api/v1/...)• Publish docs via Docker container |
| **6. Advanced Middleware & Caching***Week 5–6* | • **Rate limiting** middleware (e.g. SlowAPI)• **Redis** for caching (run via Docker)• Background tasks (e.g. email) |
| **7. File Uploads & Media***Week 7* | • Handle product image uploads to local volume• Serve static files from Docker container |
| **8. Testing & Quality Assurance***Week 8* | • Pytest unit tests + httpx.AsyncClient integration tests• Linting (flake8/isort), pre-commit hooks• Test workflow in GitHub Actions |
| **9. CI/CD with GitHub Actions***Week 9* | • Define workflow: install deps → lint → test → build Docker image• Deploy to a free runtime (e.g. Railway’s free tier or self-hosted VM) |
| **10. Observability & Monitoring***Week 10* | • Structured logging (Loguru)• Error tracking (Sentry OSS) or plain email alerts• Metrics endpoint for Prometheus (all OSS) |
| **11. Container Orchestration Basics***Week 11* | • Learn Docker Compose for multi-service dev• (Optional) Intro to Kubernetes with kind or minikube |
| **12. Next-Level Add-Ons***Week 12+* | • Real-time with WebSockets• GraphQL via Strawberry• Message queue (RabbitMQ OSS) |