

Unit III — System Design & Data Management

Software Engineering and Management | BMB IT 01

Unit III: System Design and Data Management

Syllabus: Principles of system design; Input-Output design for business applications; Design of online catalogues; File organization and design techniques; Database concepts and design.

Exam Blueprint (2025-26 paper)

Topic	2025-26 paper	Marks
Data architecture design with three essential models	Section C	7
Database and its importance in system design	Section C	7
Principles of system design	Syllabus weight	7
Input-Output design	Syllabus weight	7
File organization techniques	Syllabus weight	7
Online catalogue design	Syllabus weight	7

YE QUESTION BAAR-BAAR AAYA HAI

2025-26 me is unit se Section C ka **poora question 5** aaya — "Explain data architecture design with three essential models" aur "What is Database and how it is important in system design?" Dono Sections 5 aur 6 me hain.

1. Principles of System Design

DEFINITION - RATTA MAARO

System design is the process of defining the **architecture, modules, interfaces and data** of a system to satisfy the requirements identified during analysis. Analysis answers **WHAT**; design answers **HOW**.

1.1 Types of Design

Type	Focus	Question answered
Logical design	What the system will do, independent of technology — DFDs, ERDs, data dictionary, I/O layouts	"What data, what processes?"
Physical design	How it will actually be implemented — hardware, software, files, programs, screens	"Which database, which platform?"

Logical design comes first, then physical design.

1.2 Core Design Principles

1. **Modularity** — divide the system into small, independent, manageable modules
2. **Abstraction** — hide unnecessary detail at each level; show only what is needed
3. **Information hiding** — a module's internal data and logic are hidden from other modules; only its interface is visible
4. **Low coupling** — modules should be as **independent** of each other as possible
5. **High cohesion** — everything inside a module should belong together and serve one purpose
6. **Hierarchy / structure** — organise modules in a top-down structure chart
7. **Simplicity** — the simplest design that meets requirements is the best
8. **Completeness** — the design must cover **all** the requirements
9. **Consistency** — uniform naming, formats and conventions throughout
10. **Flexibility / maintainability** — easy to modify when requirements change
11. **Reliability and security** — build in validation, error handling and access control
12. **User-friendliness** — designed for the actual users' skills and needs

YAAD RAKHNE KA JUGAAD

Design ka golden rule: **Low coupling, high cohesion**. Modules andar se strongly juda, bahar se dheela juda. Isse ek module badlo toh baaki par asar na pade.

1.3 Coupling and Cohesion

Coupling — degree of interdependence between modules (**LOWER is better**):

Type (best → worst)	Description
Data coupling	Modules share only simple data parameters — best
Stamp coupling	A whole data structure is passed, though only part is used
Control coupling	One module passes a flag controlling another's logic
Common coupling	Modules share global data
Content coupling	One module directly modifies another's internal data — worst

Cohesion — how strongly a module's parts belong together (**HIGHER is better**):

Type (best → worst)	Description
Functional cohesion	All elements contribute to one single task — best
Sequential cohesion	Output of one element is input to the next
Communicational cohesion	Elements operate on the same data
Procedural / Temporal cohesion	Elements grouped by order or time
Logical / Coincidental cohesion	Elements grouped arbitrarily — worst