📘 Project Management Unit–5

DevOps & Other Agile Methodologies — Important Questions With Easy Explaination

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1. DevOps Overview and Components

Introduction

DevOps ka full idea hai **Development + Operations**. Isme software banane wali team aur software deploy/maintain karne wali team saath me kaam karti hain.

Definition

DevOps is a software development approach that combines development and operations teams to deliver software faster, reliably and continuously.

Why It Is Needed

Traditional method me developers code banate the aur operations team deploy karti thi. Isse delay, errors aur communication gap hota tha. DevOps ye problems solve karta hai.

Easy Explanation

DevOps ka simple formula:

```
Code → Build → Test → Deploy → Monitor → Improve
```

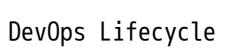
Step-by-Step Working

1. Developer code likhta hai.
2. Code GitHub/GitLab me push hota hai.
3. Automated build start hota hai.
4. Automated testing hoti hai.
5. Code deploy hota hai.
6. Application monitor hoti hai.
7. Feedback ke according improvement hota hai.

Flow of Process

```
Plan
  ↓
Code
  ↓
Build
  ↓
Test
  ↓
Release
  ↓
Deploy
  ↓
Operate
  ↓
Monitor
```

Diagram



```
Plan → Code → Build → Test → Release
  ↑                              ↓
Monitor ← Operate ← Deploy ← Feedback
```

Components of DevOps

Component	Meaning
Source Code Management	Code manage karna
Build Automation	Code ko automatically build karna
Automated Testing	Software testing automatically
Continuous Integration	Code frequently merge karna
Continuous Deployment	Code automatically deploy karna
Configuration Management	Server/settings manage karna
Monitoring	App performance check karna
Containerization	App ko container me run karna

Real-Life Analogy

Jaise restaurant me chef, waiter, billing aur delivery team coordination me kaam kare to order fast deliver hota hai. Same DevOps me development aur operations team coordination me kaam karti hain.

Advantages

- Faster software delivery
- Better teamwork
- Less manual errors
- Faster bug fixing
- Continuous feedback
- Better quality

Disadvantages

- Skilled team required
- Initial setup complex
- Tools knowledge needed
- Culture change required

Applications

- Software companies
- Cloud applications
- Banking apps
- E-commerce websites
- Mobile apps

Important Keywords

DevOps, CI/CD, Automation, Collaboration, Monitoring, Continuous Delivery, Deployment Pipeline

Conclusion

DevOps software development ko fast, reliable aur automated banata hai. It improves collaboration between development and operations teams.

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2. Docker Containerization

Introduction

Docker ek tool hai jo application ko container me pack karta hai. Container me application ke saath uski libraries, dependencies aur settings bhi hoti hain.

Definition

Docker containerization is a technique of packaging an application with its dependencies so that it can run consistently in any environment.

Why It Is Needed

Kabhi software ek computer par run hota hai but dusre par nahi. Docker is problem ko solve karta hai.

Easy Explanation

Docker ka simple idea:

```
Application + Libraries + Settings = Container
```

Step-by-Step Working

1. Developer application code likhta hai.
2. Dockerfile create hoti hai.
3. Docker image banaya jata hai.
4. Image se Docker container run hota hai.
5. Application container ke andar run karti hai.

Flow

```
Code
  ↓
Dockerfile
  ↓
Docker Image
  ↓
Docker Container
```

```
  ↓
Running App
```

Diagram

```
        Docker Container
--------------------------------
| Application Code             |
| Libraries                    |
| Dependencies                 |
| Runtime Environment          |
--------------------------------
Runs on Docker Engine
```

Real-Life Analogy

Docker container lunch box jaisa hai. Lunch box me complete food packed hota hai. Aap kahin bhi le jao, food same milega. Docker app ko same environment ke saath pack karta hai.

Advantages

- Same app everywhere
- Fast deployment
- Lightweight
- Easy scaling
- Environment problem solve

Disadvantages

- Docker knowledge required
- Security care needed

- Storage management important

Applications

- Web app deployment
- Microservices
- Testing environments
- Cloud deployment
- DevOps pipeline

Important Keywords

Docker, Container, Image, Dockerfile, Docker Hub, Portability, Lightweight

Conclusion

Docker containerization application ko portable, consistent aur easy-to-deploy banata hai.

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3. Source Code Management

Introduction

Source code management ka matlab software code ko safely store, track aur manage karna.

Definition

Source Code Management is the process of tracking and controlling changes in software code using version control tools like Git.

Why It Is Needed

Team me multiple developers kaam karte hain. SCM se pata chalta hai kisne kya change kiya.

Easy Explanation

SCM code ka history record rakhta hai. Agar galti ho jaaye to old version par wapas ja sakte hain.

Step-by-Step Working

1. Developer code likhta hai.
2. Code commit karta hai.
3. Code repository me push karta hai.
4. Team members code pull karte hain.
5. Changes track hote hain.

Flow

```
Write Code
  ↓
Commit
  ↓
Push
  ↓
Repository
  ↓
Version Tracking
```

Tools

Tool	Use
Git	Version control
GitHub	Online repository
GitLab	Repository + DevOps
Bitbucket	Team code management

Advantages

- Code history available
- Team collaboration easy
- Rollback possible
- Branching support
- Code loss avoid

Disadvantages

- Merge conflicts possible
- Tool learning required
- Wrong commit confusion create kar sakta hai

Important Keywords

Git, GitHub, Repository, Commit, Push, Pull, Branch, Version Control

Conclusion

Source code management team projects me code ko organized, safe aur trackable banata hai.

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4. Build Automation

Introduction

Build automation ka matlab source code ko automatically executable software me convert karna.

Definition

Build Automation is the process of automatically compiling, packaging and preparing software for testing or deployment.

Why It Is Needed

Manual build time-consuming hota hai aur errors aa sakte hain.

Easy Explanation

Build automation tools code ko automatically compile, test aur package kar dete hain.

Flow

```
Source Code
     ↓
Compile
     ↓
Dependencies
     ↓
Package
     ↓
Build Output
```

Tools

Tool	Use
Maven	Java build
Gradle	Java/Android build
npm	JavaScript build
Jenkins	Build automation

Advantages

- Time saving
- Less human error

- Fast delivery
- CI/CD support

Disadvantages

- Setup complex
- Build fail ho sakta hai
- Tool knowledge required

Important Keywords

Build, Compile, Package, Maven, Gradle, Jenkins, Automation

Conclusion

Build automation software delivery process ko fast, repeatable aur reliable banata hai.

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5. Continuous Integration

Introduction

Continuous Integration me developers apna code frequently shared repository me merge karte hain.

Definition

Continuous Integration is a DevOps practice where developers frequently integrate code into a shared repository and automated builds/tests are performed.

Why It Is Needed

Agar code bahut late merge hota hai to bugs aur conflicts badh jaate hain.

Working

1. Developer code likhta hai.
2. Code repository me push hota hai.
3. Automated build run hota hai.
4. Automated tests run hote hain.
5. Bugs quickly detect hote hain.

Flow

```
Code Push
   ↓
Build
   ↓
Test
   ↓
Feedback
   ↓
Fix Errors
```

Diagram

```
Developer → Git Repository → CI Server → Build/Test → Report
```

Advantages

- Bugs early detect
- Code quality improve
- Integration problems reduce
- Team productivity increase

Disadvantages

- Strong testing setup chahiye
- Failed build immediately fix karna hota hai
- Automation tools required

Important Keywords

CI, Frequent Integration, Automated Build, Automated Test, Shared Repository

Conclusion

Continuous Integration code ko regularly merge aur test karke software quality improve karta hai.

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6. Automated Testing and TDD

Introduction

Automated testing me software test automatically run hote hain. TDD me test pehle likha jata hai, code baad me.

Definition

Automated Testing is the use of tools to automatically test software. Test Driven Development is a method where tests are written before writing actual code.

Why It Is Needed

Manual testing slow hoti hai. Automated testing fast aur repeatable hoti hai.

TDD Cycle

```
Write Test
    ↓
Test Fails
    ↓
Write Code
    ↓
Test Passes
    ↓
Refactor
```

Diagram

```
TDD = Red → Green → Refactor

Red = Test fail
Green = Test pass
Refactor = Code improve
```

Types of Automated Testing

Type	Meaning
Unit Testing	Small function/module test
Integration Testing	Modules together test
Functional Testing	Feature testing
Regression Testing	Old features still work or not

Advantages

- Bugs early milte hain
- Quality improve hoti hai

- Manual effort reduce hota hai
- CI/CD support hota hai

Disadvantages

- Tests likhne me time lagta hai
- Poor tests wrong result de sakte hain
- Skilled testers required

Important Keywords

Automated Testing, TDD, Unit Test, Regression Test, Red-Green-Refactor

Conclusion

Automated testing and TDD software ko reliable aur bug-free banane me help karte hain.

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7. CI/CD Pipeline

Introduction

CI/CD pipeline ek automated process hai jo code ko build, test aur deploy karta hai.

Definition

CI/CD pipeline is an automated workflow that integrates, tests and deploys code continuously.

Why It Is Needed

Software delivery fast aur reliable banane ke liye CI/CD pipeline use hoti hai.

Pipeline Flow

```
Code
  ↓
Commit
  ↓
Build
  ↓
Test
  ↓
Deploy
  ↓
Monitor
```

Diagram

```
Developer
    ↓
Git
    ↓
CI Server
    ↓
Build
    ↓
Test
    ↓
Deployment
    ↓
Monitoring
```

Advantages

- Faster release
- Less manual work
- Early bug detection
- Reliable deployment

Disadvantages

- Initial setup difficult
- Automation failure possible
- Strong test cases needed

Important Keywords

Pipeline, CI, CD, Build, Test, Deploy, Automation

Conclusion

CI/CD pipeline DevOps ka backbone hai. It makes software delivery fast and automatic.

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8. Continuous Deployment

Introduction

Continuous Deployment me successfully tested code automatically production me deploy ho jata hai.

Definition

Continuous Deployment is a DevOps practice where every successfully tested code change is automatically released to production.

Why It Is Needed

Manual deployment slow hota hai. Continuous deployment fast release enable karta hai.

Flow

```
Code Commit
     ↓
Build
     ↓
Test
     ↓
Deploy to Production
```

CI vs Continuous Deployment

Basis	CI	Continuous Deployment
Focus	Code merge + test	Automatic release
Stage	Before deployment	After testing
Output	Tested build	Live software
Need	Build/test automation	Strong deployment automation

Advantages

- Fast delivery
- Quick bug fix release
- Less manual deployment
- Customer feedback fast

Disadvantages

- Faulty code risk
- Strong testing needed
- Monitoring required

Important Keywords

Automatic Release, Production Deployment, Deployment Pipeline, Release Automation

Conclusion

Continuous Deployment software changes ko quickly and automatically users tak pahunchata hai.

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9. Configuration Management

Introduction

Configuration management system settings, server settings aur software versions ko manage karta hai.

Definition

Configuration Management is the process of maintaining software, server and environment settings in a consistent and controlled manner.

Why It Is Needed

Different servers par different settings errors create kar sakti hain.

Working

1. Required configuration define karo.
2. Configuration file/code me store karo.
3. Automatically apply karo.
4. Monitor changes.
5. Consistency maintain karo.

Flow

```
Define Config
      ↓
Store as Code
      ↓
Apply Automatically
      ↓
Monitor
      ↓
Maintain
```

Tools

Tool	Use
Ansible	Automation
Puppet	Configuration control
Chef	Server management
Terraform	Infrastructure creation

Advantages

- Consistent environment
- Less manual error
- Fast setup
- Easy server management

Disadvantages

- Tool learning required
- Wrong config can affect systems
- Setup complex

Important Keywords

Configuration, Infrastructure as Code, Ansible, Puppet, Chef, Environment Consistency

Conclusion

Configuration management servers aur applications ko consistent and reliable environment deta hai.

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10. Automated Monitoring

Introduction

Automated monitoring application aur server performance ko continuously track karta hai.

Definition

Automated Monitoring is the process of automatically tracking system performance, logs, errors and availability.

Why It Is Needed

Deployment ke baad app ko monitor karna zaroori hota hai. Agar server down ho, to team ko alert milna chahiye.

Working

1. Monitoring tool install hota hai.
2. Metrics collect hote hain.
3. Logs analyze hote hain.
4. Alerts generate hote hain.
5. Team issue fix karti hai.

Flow

```
Application
     ↓
Metrics Collection
     ↓
Log Analysis
     ↓
Alert
     ↓
Fix Issue
```

Tools

Tool	Use
Prometheus	Metrics
Grafana	Dashboard
ELK Stack	Logs
Nagios	System monitoring

Advantages

- Fast issue detection
- Less downtime
- Better performance
- User experience improve

Disadvantages

- Setup required
- Too many alerts confusion create karte hain
- Tool maintenance needed

Important Keywords

Monitoring, Metrics, Logs, Alerts, Dashboard, Uptime, Performance

Conclusion

Automated monitoring software ko reliable, available aur performance-friendly banata hai.

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11. XP Methodology

Introduction

XP ka full form **Extreme Programming** hai. Ye Agile methodology high-quality coding aur testing par focus karti hai.

Definition

Extreme Programming is an Agile methodology focused on continuous testing, customer feedback, pair programming and frequent releases.

Why It Is Needed

XP changing requirements aur high-quality software ke liye useful hai.

XP Practices

Practice	Meaning
Pair Programming	Two developers work together
TDD	Test first, code later
Continuous Integration	Frequent code merge
Small Releases	Frequent delivery
Customer Feedback	Regular customer involvement

Flow

```
Requirement
     ↓
Write Test
     ↓
Write Code
     ↓
Integrate
     ↓
Release
     ↓
Feedback
```

Advantages

- High quality code
- Fewer bugs
- Strong teamwork
- Fast feedback

Disadvantages

- Skilled team required
- Customer availability needed
- Pair programming costly lag sakta hai

Important Keywords

XP, Pair Programming, TDD, Small Releases, Customer Feedback, Continuous Integration

Conclusion

XP software quality, testing aur customer involvement par heavily focus karta hai.

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12. FDD

Introduction

FDD ka full form **Feature Driven Development** hai. Isme software feature-by-feature develop hota hai.

Definition

FDD is an Agile methodology in which software is developed and delivered feature by feature.

Why It Is Needed

Large projects ko small features me divide karne ke liye FDD useful hai.

Steps

1. Overall model develop karo.
2. Feature list banao.
3. Feature-wise planning karo.
4. Feature-wise design karo.
5. Feature-wise build karo.

Flow

```
Overall Model
      ↓
Feature List
      ↓
```

```
Plan by Feature
      ↓
Design by Feature
      ↓
Build by Feature
```

Example

Food app features:

- login
- menu
- cart
- payment
- tracking

Advantages

- Progress clear hota hai
- Feature-wise delivery
- Large projects ke liye useful
- Customer output easily samajhta hai

Disadvantages

- Clear feature list required
- Small projects ke liye less useful
- Documentation needed

Important Keywords

Feature List, Design by Feature, Build by Feature, Feature-wise Delivery

Conclusion

FDD project ko clear features me divide karke systematic development provide karta hai.

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13. DSDM

Introduction

DSDM ka full form **Dynamic Systems Development Method** hai. Ye Agile method time and cost control par focus karta hai.

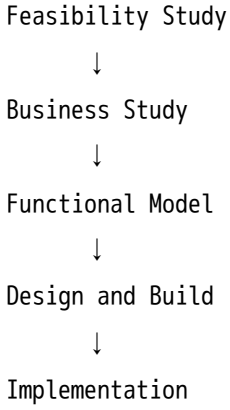
Definition

DSDM is an Agile methodology focused on business needs, user involvement, time-boxing and frequent delivery.

Why It Is Needed

Business projects me fast delivery, fixed time aur user involvement important hote hain.

Steps



Principles

Principle	Meaning
User involvement	Users regularly involved
Frequent delivery	Product parts delivered often
Time-boxing	Fixed time periods
Business focus	Business value important
Quality control	Quality maintained

Advantages

- Business-focused
- Good time control
- User feedback strong
- Frequent delivery

Disadvantages

- User involvement compulsory
- Trained team required
- Small projects me heavy lag sakta hai

Important Keywords

DSDM, Time-boxing, User Involvement, Business Focus, Iterative Development

Conclusion

DSDM business projects ke liye useful Agile methodology hai jahan time, cost aur user feedback important hote hain.

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14. Crystal Methodology

Introduction

Crystal Agile methodologies ka group hai. Ye people, communication aur teamwork par focus karta hai.

Definition

Crystal is a family of Agile methodologies that focuses on people, communication, teamwork and project size.

Why It Is Needed

Har project same nahi hota. Crystal project size aur team ke according method choose karta hai.

Types

Type	Suitable For
Crystal Clear	Small teams
Crystal Yellow	Medium teams
Crystal Orange	Large teams

Flow

```
Team Size
   ↓
Project Criticality
   ↓
Select Crystal Type
   ↓
Team Communication
   ↓
Delivery
```

Advantages

- Flexible
- People-focused
- Simple
- Good communication

Disadvantages

- Less documentation
- Team skill par dependent
- Regulated projects ke liye weak

Important Keywords

Crystal, People-focused, Communication, Teamwork, Lightweight Method

Conclusion

Crystal methodology team communication aur flexibility par focus karti hai.

🔥 Comparison Table: XP vs FDD vs DSDM vs Crystal

Basis	XP	FDD	DSDM	Crystal
Focus	Coding quality	Features	Business value	People & communication
Best For	Changing software	Large feature-based projects	Business projects	Team-based projects
Main Practice	TDD, Pair Programming	Build by feature	Time-boxing	Communication
Customer Role	Very high	Medium	High	Medium
Documentation	Low	Medium	Medium	Low
Strength	Quality	Clear progress	Time control	Flexibility

Which is Better and Why?

No single method is best for all projects.

- **XP** best hai jab software quality aur testing important ho.
- **FDD** best hai jab project feature-wise divide ho sakta ho.
- **DSDM** best hai jab time, cost aur business need important ho.
- **Crystal** best hai jab small team aur communication strong ho.

🔥 Most Important 7-Mark Questions

1. Explain DevOps and its components.
2. Explain Docker containerization.
3. Explain Continuous Integration.
4. Explain CI/CD pipeline.
5. Explain Automated Testing and TDD.
6. Explain Continuous Deployment.
7. Explain Configuration Management.
8. Explain Automated Monitoring.
9. Explain XP methodology.
10. Explain FDD.
11. Explain DSDM.
12. Explain Crystal methodology.

⭐ Most Important 14-Mark Questions

1. Explain DevOps lifecycle with components and diagram.
2. Explain CI/CD pipeline with build, testing and deployment.
3. Explain Docker containerization and its role in DevOps.
4. Explain automated testing, TDD and continuous integration.
5. Explain XP, FDD, DSDM and Crystal methodologies with comparison.

6. Explain source code management, build automation and configuration management.

🎯 PYQ-Based Expected Questions

Very High Probability

✅ DevOps overview and components
✅ Docker containerization
✅ Continuous Integration
✅ CI/CD pipeline
✅ XP methodology

High Probability

✅ Automated Testing and TDD
✅ Continuous Deployment
✅ Configuration Management
✅ FDD
✅ DSDM

Medium Probability

✅ Automated Monitoring
✅ Crystal methodology
✅ Source code management
✅ Build automation

⚡ One-Night Revision Notes

Topic	One-Line Revision
DevOps	Development + Operations

Topic	One-Line Revision
Docker	App packed with dependencies
Git	Source code version control
Build Automation	Code to software automatically
CI	Frequent code merge + test
CD	Automatic delivery/deployment
TDD	Test first, code later
Monitoring	Track app health
XP	Coding quality + TDD
FDD	Feature-wise development
DSDM	Business focus + time-boxing
Crystal	People + communication

📌 Smart Study Plan

2-Hour Revision Strategy

Time	Topic
25 min	DevOps lifecycle
20 min	Docker
20 min	CI/CD
15 min	Testing + TDD
15 min	Configuration + Monitoring
25 min	XP, FDD, DSDM, Crystal

5-Hour Preparation Strategy

Time	Topic
1 hour	DevOps + Components
1 hour	Docker + SCM + Build
1 hour	CI/CD + Testing

Time	Topic
1 hour	Deployment + Monitoring
1 hour	XP + FDD + DSDM + Crystal

One-Night Priority Order

1. DevOps overview
2. Docker containerization
3. Continuous Integration
4. CI/CD pipeline
5. Automated Testing and TDD
6. Continuous Deployment
7. XP
8. FDD
9. DSDM
10. Crystal
11. Configuration Management
12. Monitoring

🧠 Memory Tricks

DevOps Lifecycle

PCBT-RDOM

- P = Plan
- C = Code
- B = Build
- T = Test
- R = Release
- D = Deploy
- O = Operate

- M = Monitor

TDD

RGR

- R = Red
- G = Green
- R = Refactor

FDD

MFPDB

- M = Model
- F = Feature List
- P = Plan by Feature
- D = Design by Feature
- B = Build by Feature

Agile Methods

XDFC

- X = XP
- D = DSDM
- F = FDD
- C = Crystal

🚀 Topper Answer Writing Tips

For 7 Marks

Definition
↓
Easy Explanation
↓
Flowchart
↓
Advantages
↓
Applications
↓
Conclusion

For 14 Marks

Introduction
↓
Definition
↓
Components / Steps
↓
Detailed Diagram
↓
Example
↓
Advantages
↓
Disadvantages
↓
Applications
↓
Conclusion

Keywords to Underline

DevOps, CI/CD, Docker, Container, Source Code Management, Build Automation, Automated Testing, TDD, Configuration Management, Continuous Deployment, Monitoring, XP, FDD, DSDM, Crystal

Final Tip

Agar time bahut kam hai, to sabse pehle **DevOps lifecycle + Docker + CI/CD + XP/FDD/DSDM/Crystal comparison** prepare karo. Unit–5 me ye sabse scoring topics hain.