

Project Management Unit–2 [Important Questions With Detailed Answers

RGPV Topper-Level Notes: PERT, CPM, Critical Path, Float, Crashing, Resource Leveling

1. PERT

Program Evaluation and Review Technique

Introduction

PERT ek project scheduling technique hai. Iska use tab hota hai jab project activities ka exact time fixed nahi hota.

Example: Research project, software development, new product design.

Definition

PERT is a probabilistic project scheduling technique used to plan, schedule and control projects where activity time is uncertain.

Why It Is Needed

PERT helps to:

- uncertain time ko estimate karna
- project completion time find karna
- critical activities identify karna
- delay avoid karna

Easy Explanation

PERT me activity ke liye 3 time estimates liye jaate hain:

Time	Meaning
Optimistic Time	Minimum possible time
Most Likely Time	Normal expected time
Pessimistic Time	Maximum possible time

Formula

$$T_e = \frac{T_o + 4T_m + T_p}{6}$$

Where:

- **To** = Optimistic time
- **Tm** = Most likely time
- **Tp** = Pessimistic time
- **Te** = Expected time

Step-by-Step Working

1. Project activities identify karo.
2. Activities ka sequence decide karo.
3. Har activity ke 3 time estimates lo.
4. Expected time calculate karo.
5. Network diagram banao.
6. Critical path find karo.
7. Project completion time calculate karo.

Flow of Process

Activities Identify
↓
Time Estimate
↓
Network Diagram
↓
Expected Time
↓
Critical Path
↓
Project Completion Time

Diagram

Start → A → B → D → End
↓
C ————— ↑

Real-Life Analogy

Jaise exam preparation me exact time nahi pata hota.

Aap sochte ho:

- best case: 2 hours
- normal: 4 hours
- worst case: 6 hours

PERT isi uncertainty ko handle karta hai.

Advantages

- uncertain projects me useful
- planning better hoti hai

- delay identify hota hai
- critical activities clear hoti hain
- large projects ke liye helpful

Disadvantages

- calculation complex ho sakti hai
- accurate estimation difficult hota hai
- large network banana time-consuming hota hai

Applications

- software development
- research projects
- defense projects
- space projects
- product development

Important Keywords

Probabilistic, Optimistic Time, Most Likely Time, Pessimistic Time, Expected Time, Network Diagram, Critical Path

Conclusion

PERT uncertain projects ke liye best technique hai. Ye project manager ko time estimation aur planning me help karta hai.

2. CPM

Critical Path Method

Introduction

CPM project scheduling technique hai jisme activity time fixed maana jaata hai. Ye mostly construction aur production projects me use hota hai.

Definition

CPM is a deterministic project scheduling technique used to find the critical path and minimum project completion time when activity durations are known.

Why It Is Needed

- project duration find karne ke liye
- delay avoid karne ke liye
- critical activities identify karne ke liye
- cost and time control ke liye

Easy Explanation

CPM me project ko activities me divide karte hain.

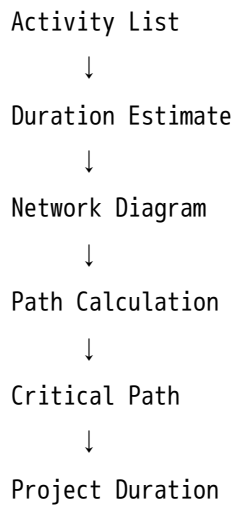
Phir network diagram bana kar longest path find karte hain.

Longest path hi **Critical Path** hota hai.

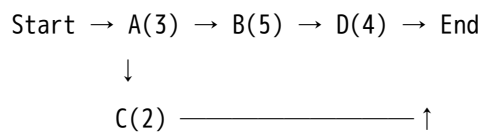
Step-by-Step Working

1. Activities list karo.
2. Duration assign karo.
3. Activity sequence decide karo.
4. Network diagram banao.
5. All paths ka duration calculate karo.
6. Longest path find karo.
7. Longest path = critical path.

Flow of Process



Diagram



Real-Life Analogy

Ghar banate time kuch work sequence me hota hai:

- foundation
- walls
- roof
- finishing

Foundation late hua to pura ghar late ho jayega. Ye critical activity hai.

Advantages

- project duration clear hota hai
- critical activities identify hoti hain
- time control easy hota hai
- cost reduction possible hota hai
- project monitoring easy hoti hai

Disadvantages

- uncertain projects ke liye suitable nahi
- large project me network complex hota hai
- time estimates fixed hone chahiye

Applications

- construction
- manufacturing
- maintenance projects
- production planning
- civil engineering projects

Important Keywords

Deterministic, Critical Path, Longest Path, Activity Duration, Network Diagram, Float, Scheduling

Conclusion

CPM fixed-time projects ke liye useful technique hai. It helps in finding project duration and controlling delays.

3. Difference Between PERT and CPM

Introduction

PERT aur CPM dono project scheduling techniques hain, but dono ka use alag type ke projects me hota hai.

Comparison Table

Basis	PERT	CPM
Full Form	Program Evaluation and Review Technique	Critical Path Method
Nature	Probabilistic	Deterministic
Time Estimate	3 time estimates	1 time estimate
Used For	Uncertain projects	Fixed-time projects
Main Focus	Time planning	Time and cost control
Example	Research, software	Construction, manufacturing
Activity Type	Non-repetitive	Repetitive
Cost Focus	Less	More
Complexity	More complex	Less complex

Memory Trick

PERT = Probability

CPM = Cost + Path Management

Important Keywords

Probabilistic, Deterministic, Expected Time, Critical Path, Time-Cost Optimization

Conclusion

PERT is best for uncertain projects, while CPM is best for fixed and repetitive projects.

4. Critical Path

Introduction

Critical Path project network ka longest path hota hai. Ye minimum project completion time batata hai.

Definition

Critical Path is the longest path in a project network which determines the shortest possible completion time of the project.

Why It Is Needed

- project completion time find karne ke liye
- important activities identify karne ke liye
- delay control karne ke liye

Easy Explanation

Agar critical path ki koi activity delay hoti hai, to pura project delay ho jaata hai.

Critical path activities ka float zero hota hai.

Step-by-Step Working

1. Network diagram banao.
2. Sabhi paths identify karo.
3. Har path ka total duration calculate karo.
4. Longest duration wala path choose karo.
5. Ye longest path critical path hota hai.

Diagram

Path 1: Start → A(3) → B(4) → End = 7 days

Path 2: Start → C(5) → D(6) → End = 11 days

Critical Path = C → D

Project Duration = 11 days

Advantages

- important activities clear hoti hain
- delay control hota hai
- project monitoring easy hoti hai
- resource allocation better hota hai

Disadvantages

- network diagram accurate hona chahiye
- large projects me calculation lengthy hoti hai

Important Keywords

Longest Path, Zero Float, Critical Activity, Project Duration, Network Analysis

Conclusion

Critical path project ka backbone hota hai. Iski activities delay nahi honi chahiye.

5. Float Calculation

Introduction

Float ka matlab hai kisi activity ke paas available extra time. Agar activity thoda late ho jaye aur project delay na ho, to wo extra time float hota hai.

Definition

Float is the amount of time by which an activity can be delayed without delaying the project completion time.

Formula

$$\text{Float} = \text{LS} - \text{ES} = \text{LF} - \text{EF}$$

Where:

- ES = Earliest Start
- LS = Latest Start
- EF = Earliest Finish
- LF = Latest Finish

Types of Float

Type	Meaning
Total Float	Activity kitni delay ho sakti hai without delaying project
Free Float	Activity kitni delay ho sakti hai without delaying next activity
Independent Float	Delay allowed without affecting previous and next activities

Step-by-Step Working

1. Earliest start calculate karo.
2. Earliest finish calculate karo.
3. Latest start calculate karo.
4. Latest finish calculate karo.
5. Formula apply karo.
6. Jiska float zero hai, wo critical activity hai.

Diagram

Activity A:

ES = 2

LS = 5

Float = LS - ES = 5 - 2 = 3 days

Advantages

- schedule flexibility milti hai
- non-critical activities identify hoti hain
- resource shifting easy hota hai
- delay management possible hota hai

Disadvantages

- wrong float calculation project delay kar sakti hai
- complex networks me calculation difficult hoti hai

Important Keywords

Slack, Total Float, Free Float, ES, LS, EF, LF, Zero Float

Conclusion

Float project manager ko batata hai ki kaunsi activity safely delay ho sakti hai aur kaunsi nahi.

6. Crashing

Introduction

Crashing ka matlab project duration reduce karna by adding extra resources.

Definition

Crashing is the process of reducing project completion time by increasing resources at minimum additional cost.

Why It Is Needed

- project delay avoid karne ke liye
- deadline meet karne ke liye
- urgent project complete karne ke liye

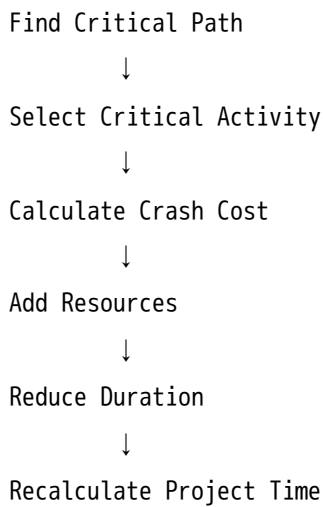
Easy Explanation

Agar website 10 din me banani thi but client 6 din me chahta hai, to extra developers hire karna padega. Ye crashing hai.

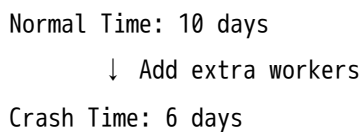
Step-by-Step Working

1. Critical path identify karo.
2. Critical activities choose karo.
3. Crash cost calculate karo.
4. Minimum crash cost wali activity select karo.
5. Extra resource add karo.
6. Project duration reduce karo.
7. Critical path dobara check karo.

Flow



Diagram



Crash Cost Formula

Crash Cost Slope = $\frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}}$
 $\text{Crash Cost Slope} = \frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}}$

Advantages

- project fast complete hota hai
- delay penalty avoid hoti hai
- customer satisfaction badhta hai

Disadvantages

- cost increase hoti hai
- workers par pressure badhta hai
- quality affect ho sakti hai

Applications

- construction deadlines
- software release deadlines
- emergency projects
- event management

Important Keywords

Crash Time, Normal Time, Crash Cost, Cost Slope, Critical Activity, Time Reduction

Conclusion

Crashing useful hai jab project ko jaldi complete karna ho, but cost increase ko carefully manage karna chahiye.

7. Resource Leveling

Introduction

Resource Leveling ka purpose resources ka balanced use karna hai. Isse overloading aur underutilization avoid hoti hai.

Definition

Resource Leveling is a scheduling technique used to balance resource demand by adjusting activity start and finish times.

Why It Is Needed

- resources limited hote hain
- workers overload ho sakte hain
- machines ek time par multiple tasks me use nahi ho sakti
- smooth workload maintain karna hota hai

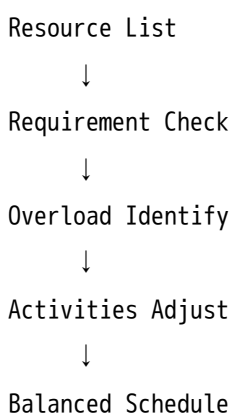
Easy Explanation

Agar ek developer ko same time par 3 tasks assign kar diye, to kaam delay hoga. Resource leveling schedule adjust karke workload balance karta hai.

Step-by-Step Working

1. Available resources identify karo.
2. Activity resource requirement check karo.
3. Overloaded resources find karo.
4. Non-critical activities shift karo.
5. Float ka use karo.
6. Balanced schedule prepare karo.

Flow



Diagram

Before Leveling:

Worker A → Task 1 + Task 2 + Task 3

After Leveling:

Day 1 → Task 1

Day 2 → Task 2

Day 3 → Task 3

Advantages

- resource overload reduce hota hai
- productivity improve hoti hai
- workload balanced hota hai
- cost control better hota hai

Disadvantages

- project duration increase ho sakta hai
- scheduling complex ho sakti hai
- critical activities shift nahi kar sakte

Applications

- software teams
- construction labor planning
- machine scheduling
- manufacturing units

Important Keywords

Resource Allocation, Workload Balance, Overload, Underutilization, Scheduling Adjustment

Conclusion

Resource leveling ensures available resources are used efficiently without overload.

8. Precedence Relationship

Introduction

Precedence relationship activities ke order ko define karta hai. Ye batata hai ki kaunsi activity pehle hogi aur kaunsi baad me.

Definition

Precedence Relationship is the logical dependency between project activities that defines their sequence of execution.

Types

Type	Meaning	Example
Finish to Start	A finish hone ke baad B start	Coding ke baad testing
Start to Start	A start hote hi B start	Design and documentation
Finish to Finish	A finish hone par B finish	Testing and report
Start to Finish	A start hone par B finish	Rare case

Easy Explanation

Testing coding ke pehle start nahi ho sakti.

So coding and testing ke beech **Finish-to-Start** relationship hai.

Step-by-Step Working

1. Activities identify karo.
2. Dependency check karo.
3. Relationship type decide karo.
4. Network diagram me show karo.
5. Schedule prepare karo.

Diagram

Finish-to-Start:

Activity A —————> Activity B
Coding finished → Testing starts

Advantages

- proper activity sequence banta hai
- confusion avoid hota hai
- project schedule accurate hota hai
- dependencies clear hoti hain

Disadvantages

- wrong dependency se project delay ho sakta hai
- large projects me dependency tracking difficult hoti hai

Important Keywords

Dependency, Sequence, Finish-to-Start, Start-to-Start, Finish-to-Finish, Scheduling Logic

Conclusion

Precedence relationship project activities ka logical order define karta hai and accurate scheduling me help karta hai.

9. PERT/Cost

Introduction

PERT/Cost project ke time and cost dono ko control karne ki technique hai. Ye planned cost aur actual cost compare karta hai.

Definition

PERT/Cost is a project cost control technique that integrates project scheduling with cost monitoring and control.

Why It Is Needed

- budget control ke liye
- cost overrun avoid karne ke liye
- planned vs actual cost compare karne ke liye
- project performance measure karne ke liye

Easy Explanation

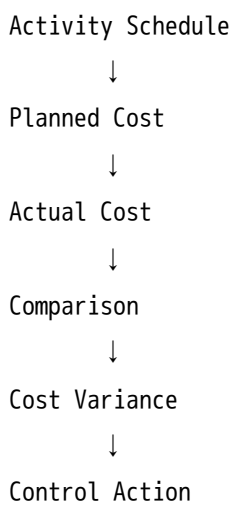
Agar project ka planned cost ₹50,000 tha but actual cost ₹70,000 ho gaya, to project budget se bahar ja raha hai. PERT/Cost is difference ko track karta hai.

Step-by-Step Working

1. Project activities define karo.

2. Har activity ka planned cost calculate karo.
3. Project schedule prepare karo.
4. Actual cost record karo.
5. Planned cost vs actual cost compare karo.
6. Variance find karo.
7. Corrective action lo.

Flow



Diagram



Advantages

- budget control hota hai
- cost overrun detect hota hai
- project performance clear hoti hai
- management decision easy hota hai

Disadvantages

- data collection difficult hota hai
- continuous monitoring required
- large projects me complex hota hai

Applications

- construction projects
- software projects
- government projects
- defense projects
- large industrial projects

Important Keywords

Planned Cost, Actual Cost, Cost Variance, Budget Control, Cost Monitoring, Corrective Action

Conclusion

PERT/Cost project manager ko time ke saath cost control karne me help karta hai.



Most Important 7-Mark Questions

1. Explain PERT with formula and example.
2. Explain CPM with network diagram.
3. Differentiate between PERT and CPM.

4. Define critical path and explain its importance.
 5. Explain float and types of float.
 6. Explain crashing of activities.
 7. Explain resource leveling.
 8. Explain precedence relationship.
 9. Write short note on PERT/Cost.
-

Most Important 14-Mark Questions

1. Explain PERT and CPM in detail with difference table.
 2. Explain critical path method with network diagram and float calculation.
 3. Explain crashing of activities with cost slope formula.
 4. Explain project scheduling techniques: PERT, CPM, float and critical path.
 5. Explain resource scheduling, resource leveling and PERT/Cost.
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PYQ-Based Expected Questions

Very High Probability

- PERT
- CPM
- Difference between PERT and CPM
- Critical Path

High Probability

- Float Calculation
- Crashing
- Resource Leveling

Medium Probability

- Precedence Relationship
- PERT/Cost

One-Night Revision Notes

Topic	One-Line Revision
PERT	Uncertain time project scheduling
CPM	Fixed time project scheduling
Critical Path	Longest path in network
Float	Extra available time
Crashing	Reducing project time by extra cost
Resource Leveling	Balancing resources
Precedence	Activity dependency
PERT/Cost	Cost control with scheduling

Must Remember Formulas

$$T_e = T_o + 4T_m + T_p \quad T_e = \frac{T_o + 4T_m + T_p}{6}$$

$$\text{Float} = LS - ES = LF - EF$$

$$\text{Crash Cost Slope} = \frac{\text{Crash Cost} - \text{Normal Cost}}{\text{Normal Time} - \text{Crash Time}}$$

Smart Study Plan

2-Hour Plan

Time	Topic
25 min	PERT

Time	Topic
25 min	CPM
20 min	Difference table
20 min	Critical Path + Float
20 min	Crashing
10 min	Resource Leveling + PERT/Cost

5-Hour Plan

Time	Study
1 hour	PERT + formula
1 hour	CPM + Critical Path
1 hour	Float + numericals
1 hour	Crashing + Resource Leveling
1 hour	PYQ + diagrams + revision



Memory Tricks

PERT

PERT = Probability

Time uncertain hota hai.

CPM

CPM = Critical Path Method

Longest path find karta hai.

Float

Float = Free Time

Critical Path

Longest Path = Project Duration

Crashing

Crash = Fast Finish with Extra Cost

Resource Leveling

Leveling = Balance Workload



Topper Answer Writing Tips

For every 7-mark answer:

Definition



Explanation



Diagram



Advantages



Conclusion

For every 14-mark answer:

Introduction



Definition



Detailed Explanation

↓

Formula

↓

Diagram

↓

Example

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Advantages

↓

Disadvantages

↓

Applications

↓

Conclusion

Keywords to Underline

PERT, CPM, Critical Path, Float, Slack, Crashing, Resource Leveling, Network Diagram, Cost Control, Schedule Control

Final Priority for Exam

Study in this order:

1. PERT
2. CPM
3. Difference between PERT and CPM
4. Critical Path
5. Float Calculation
6. Crashing
7. Resource Leveling
8. PERT/Cost
9. Precedence Relationship