

## CONTENTS

KOE 068 : Software Project Management

UNIT-1 : PROJECT EVALUATION & PLANNING (1-1 K to 1-25 K)

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

## **UNIT-2 : PROJECT LIFE CYCLE (2-1 K to 2-28 K)**

Software process and Process Models – Choice of Process models  
- Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming- Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – a Parametric Productivity Model.

## **UNIT-3 : ACTIVITY PLANNING AND RISK MANAGEMENT**

(3-1 K to 3-20 K)

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT-4 : PROJECT MANAGEMENT & CONTROL (4-1 K to 4-20 K)

Framework for Management and control Collection of data Visualizing progress – Cost monitoring Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control Software Configuration Management – Managing contracts – Contract Management.

UNIT-5 : STAFFING IN SOFTWARE PROJECTS (5-1 K to 5-20 K)

Managing people – Organizational behavior – Best methods of staff selection Motivation – The Oldham Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams Decision making Organizational structures Dispersed and Virtual teams – Communications genres Communication plans Leadership.

## **SHORT QUESTIONS**

**(SQ-1 K to SQ-12 K)**

**PART - 1**

*Importance of Software Project Management, Activities, Methodologies.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 1.1.** What is project ? Explain the characteristics of project.

**Answer****Project :**

1. A project is defined as a sequence of tasks that must be completed to attain a certain outcome.
2. It is a temporary venture to produce a new and unique deliverable.
3. A deliverable could be a tangible product, a service or achievement of a required outcome.
4. It is a sub-discipline of project management in which software projects are planned, implemented, monitored and controlled.

**Characteristics of project :** Following are the characteristics of project :

1. Non-routine tasks are involved.
2. Planning is required.
3. Specific objectives are to be met.
4. The project has a pre-determined time span.
5. Work is carried out in several phases.
6. The resources that are available for use on the project are constrained.

**Que 1.2.** What is project management ?

**Answer**

1. Project management is the art of maximizing the probability that a project delivers its goals on time, within budget and at the required quality.
2. A project can be captured on paper with a few simple elements : a start date, an end date, the tasks that have to be carried out and when they should be finished, and some idea of the resources (people, machines etc.) that will be needed during the course of the project.

3. Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.
4. Project management is accomplished through the use of the processes such as : initiating, planning, executing, controlling, and closing.
5. The processes within project management are iterative in nature.

**Que 1.3.** Write short note on software project management.

**Answer**

1. Software project management is an art and discipline of planning and supervising software projects.
2. It is a sub-discipline of project management in which software projects are planned, implemented, monitored and controlled.
3. It is a procedure of managing, allocating and timing resources to develop computer software that fulfills requirements.
4. Following are the advantages of software project management :
  - a. It helps in planning of software development.
  - b. Implementation of software development is made easy.
  - c. Monitoring and controlling are aspects of software project management.
  - d. It overall manages to save time and cost for software development.

**Que 1.4.** What are the objectives of SPM ?

**Answer**

Basic objectives of SPM are as follows :

1. Define the project.
2. Reduce it to a set of manageable tasks.
3. Obtain appropriate and necessary resources.
4. Build a team to perform the project work.
5. Plan the work and allocate the resources to the tasks.
6. Monitor and control the work.
7. Report progress to senior management and/or the project sponsor.
8. Close down the project when completed.
9. Review it to ensure the lessons are learnt and widely understood.

**Que 1.5.** Discuss the structure of a Software Project Management Plan (SPMP) in detail.

**Answer**

The structure of software project plan is as follows :

1. **Overview**
  - a. Project purpose, objectives, and success criteria
  - b. Project deliverables
  - c. Assumptions, dependencies, and constraints
  - d. References
  - e. Definitions and acronyms
  - f. Evolution of the plan
2. **Project organization**
  - a. External interfaces
  - b. Internal structure
  - c. Roles and responsibilities
3. **Managerial process plans**
  - a. Start-up plans
    - i. Estimation plan
    - ii. Staffing plan
    - iii. Staff training plan
    - iv. Resource acquisition plan
    - v. Project commitments
  - b. Work plan
  - c. Control plan
    - i. Data control plan
    - ii. Requirements control plan
    - iii. Schedule control plan
    - iv. Budget control plan
    - v. Communication, tracking, and reporting plan
    - vi. Metrics collection plan
    - vii. Risk management plan
    - viii. Issue resolution plan
    - ix. Project close-out plan
4. **Technical process plans**
  - a. Process model
  - b. Methods, tools, and techniques
  - c. Configuration management plan
  - d. Quality assurance plan

- e. Documentation plan
- f. Process improvement plan

**Que 1.6.** Explain the importance of software project management.

**Answer**

Software project management is important as :

1. It helps every part of the business run more smoothly.
2. It allows team to focus on the work that matters, free from the distractions caused by tasks going off track or budgets spinning out of control.
3. It empowers to deliver results that actually impact the business's bottom line.
4. It enables employees to see how their work contributes to the company's strategic goals.
5. It reduces the complexity of collaboration, increase transparency, and ensure accountability, even when working across teams or departments.

**Que 1.7.** Explain project planning steps for developing a software management project for library management system.

**Answer**

Project planning steps for library management system :

**Step 0 : Select project**

1. We select project to develop software for library management system.
2. For this, we have to check how many institutes are willing to buy the software.

**Step 1 : Identify project scope and objectives :**

1. Scope and objectives of the project can be defined as to keep track of following :
  - i. The books issued to the students.
  - ii. Stock of book available in the library.
  - iii. Total amount of due fine on the students.
  - iv. Record of students who have received / returned the books in library.

**Step 2 : Identify project infrastructure :**

1. In this phase we emphasize on the technologies which are using for developing software.

**Step 3 : Analyze project characteristics :**

1. In this phase, we have worked on the features provided in the software which makes it more presentable.
2. For this software, we have included following characteristics :
  - i. User will login with their unique user id / password to access the software.
  - ii. One can easily check the availability of books.

**Step 4 : Identify project products and activities :**

1. In this phase, we have focused on the activities performed in the software and the products available in the software.
2. In our project we have the following :
  - i. Login portal.
  - ii. Database of number of books issued to the students / faculty.
  - iii. Record of students :
    - a. For their dues.
    - b. For books issued to them.
  - iv. User can check the availability of books according to,
    - a. Demand of students.
    - b. Current syllabus.

**Step 5 : Estimate effort for each activity :**

1. In this step, we have estimated time needed for each module.
2. In our project we have three modules which are as follows :
  - i. Front end
  - ii. Back end
  - iii. Database

**Step 6 : Identify risk :**

1. In this phase, we have to check for all the possible risks related to our project.
2. In our project, possible risks are as follows :
  - i. Requirements are not fulfilled properly.
  - ii. Some features may not be feasible.
  - iii. Perhaps we have taken less physical storage space for our database.
  - iv. Security features of our software are not tamper proof.

**Step 7 : Allocate resources :**

1. We have selected appropriate technology for each module.
2. We have assigned qualified team members for each module.

**Step 8 : Review plan :**

1. In this phase, we have developed all the possible test cases to check the working of software.
2. Also, we have executed all test cases for finding exception and error in the program.

**Step 9 and 10 : Execute plan / Lower level of planning :**

1. If some exception or error is found in software then we identify that module and modify it as needed.

**Que 1.8. What are the activities involved in project management ?****Answer**

Following are the activities involved in project management :

1. **Planning** : Deciding what is to be done.
2. **Organizing** : Making arrangements.
3. **Staffing** : Selecting the right people for the job, etc.
4. **Directing** : Giving instructions.
5. **Monitoring** : Checking on progress.
6. **Controlling** : Taking action to remedy hold-ups.
7. **Innovating** : Coming up with new solutions.
8. **Representing** : Liaising with users, etc.

**Que 1.9. Explain different methodologies used in software project management.****Answer**

Different methodologies used in software project management are :

1. **Agile development methodology** :
  - a. Teams use the agile development methodology to minimize risk (such as bugs, cost overruns, and changing requirements) when adding new functionality.
  - b. In this method, teams develop the software in iterations that contain mini-increments of the new functionality.
2. **DevOps deployment methodology** :
  - a. DevOps is a set of practices that supports an organizational culture.
  - b. DevOps deployment centers on organizational change that enhances collaboration between the departments responsible for different segments of the development life cycle, such as development, quality assurance, and operations.

**3. Waterfall development method :**

- a. The waterfall method is a rigid linear model that consists of sequential phases (requirements, design, implementation, verification, maintenance) focusing on distinct goals.
- b. There's usually no process for going back to modify the project or direction.

**4. Rapid application development :**

- a. Rapid Application Development (RAD) is a condensed development process that produces a high-quality system with low investment costs.
- b. This allows developers to quickly adjust to shifting requirements in a fast-paced and constantly changing market.
- c. The ability to quickly adjust allows low investment cost.

**PART-2**

*Categorization of Software Projects, Setting Objectives, Management Principles, Management Control.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions****Que 1.10. Discuss various types of software projects.****Answer**

Following are the types of software projects :

1. **System software** :
  - a. System software is a collection of programs that are written to provide services to other programs.
  - b. The examples of system software are compiler, editor, file management utilities etc.
2. **Business software** :
  - a. Business information processing is the largest single software application area.
  - b. The examples of business application area are payroll, inventory management, marketing, purchase etc.

**3. Embedded software :**

- Embedded software resides in read only memory and is used to control products and systems for the consumer and markets.
- Examples of embedded software are washing machine, microwave oven, air conditioner, etc.

**4. Engineering and scientific software :**

- Engineering and scientific software have been categorized by number crunching algorithms.
- Examples of such types of software are Computer Aided Design (CAD), Computer Aided Manufacturing (CAM), simulation etc.

**5. Personal computer software :**

- Personal computer software for small business application is used by single user.
- For example, word processor, spreadsheet, multimedia, entertainment, database management, small business financial application etc.

**6. Real time software :**

- Software that monitors/analyzes/controls real world events as they occur is known as real time software.
- Elements of real time software include data gathering, analysing, controlling and monitoring.

**7. Artificial intelligence software :**

- Artificial intelligence software makes use of non-numerical algorithms to solve the complex problem that cannot be solved by straight forward analysis.
- For example, pattern recognition (image or voice), artificial neural network, theorem proving, game playing etc.

**Que 1.11. | How do we identify the planning objectives ?****Answer**

- After all the stakeholders are identified, it is critical to identify what each stakeholder expects to gain from the project.
- For instance, for an end user it might be that they are expecting a very user friendly and robust software with a number of features, while for a maintainer it is the quality of the documentation and the modifiability of the system that are important.
- A manager would not want any overruns to the schedule, while the person who approves the budget might expect a low budget project.
- By identifying each of the stakeholders "win" condition, the project's objectives are clear from the start.

- In the negotiation with the customer, these objectives should be reinforced and documented.
- Steps to identify the objectives are as follows :
  - Identify and allocate resources.
  - Understand how people will benefit from the project.
  - Prioritize objectives for the project.
  - Establish reasonable expectations on the parts of all the stakeholders.
  - Transform these objectives into project activities.
  - Identify and manage the risks.
  - Keep senior management and the customer aware of the status of the project at all times.

**Que 1.12. | What are the phases of project management ?****Answer**

Following are the phases involved in project management :

- Step 1 : Project initiation and conception :** Initiation begins after receiving a request from a client or discovering a business need. Stakeholders determine whether or not accomplishing this project is feasible and valuable for the business.
- Step 2 : Planning and ideation :** When project viability is decided, the next step is to put together a project management plan that will guide us through the execution process.
- Step 3 : Project launch and execution :** Once plan is in place, it's time to put it into action, amend plan based on changing circumstances.
- Step 4 : Project monitoring :** Throughout the execution process, we need to monitor, measure, and report project management metrics.
- Step 5 : Closure and presentation :** Time to tie up all of the loose ends by developing final project reports and presenting deliverables to the stakeholders.

**Que 1.13. | Explain software management principles.****Answer**

Following are the software management principles :

- Architecture first approach :**
  - In this approach main aim is to build a strong architecture for our software.
  - All the ambiguities and flaws are being identified during this phase.

- c. Also, we can take all the decisions regarding the design of the software which will enhance the productivity of our software.
- 2. Iterative life cycle process :**
- a. In iterative life cycle process we repeat the process again and again to eliminate the risk factors.
  - b. An iterative life cycle has four steps requirement: gathering, design, implementation, and testing.
  - c. Iterative life cycle process is important to eliminate risk at an early stage by repeating the above-mentioned steps again and again.
- 3. Component based approach :**
- a. In component-based approach we reuse the previously defined functions for the software development.
  - b. We reuse the part of code in the form of components. Component-based UI development optimizes the requirements and design process.
- 4. Change management system :**
- a. Change management is the process responsible for managing all changes.
  - b. The main aim of change management is to improve the quality of software by performing necessary changes.
  - c. All changes implemented are tested and certified.
- 5. Round trip engineering :**
- a. In round trip engineering, code generation and reverse engineering take place at the same time in a dynamic environment.
  - b. Both components are integrated so that developers can easily work on both of them.
  - c. Characteristic of round trip engineering is automatic update of artifacts.
- 6. Model-based evolution :**
- a. A model-based approach supports the evolution of graphics and textual notions.
- 7. Objective quality control :**
- a. The objective of quality control is to improve the quality of our software.
  - b. It involves quality management plan, quality metrics, quality checklist, quality baseline, and quality improvement measures.
- 8. Evolving levels of details :**
- a. Plan intermediate releases in groups of usage scenarios with evolving levels of details.

- b. We must plan an incremental realize in which we have an evolving level of use case, architecture, and details.
- 9. Establish a configurable process :**
- a. Establish a configurable process that is economically scalable.
  - b. We must use a configurable process which can deal with various applications.
- 10. Demonstration Based approach :**
- a. In this approach, we mainly focus on demonstration.
  - b. It helps in the increase of productivity and quality of our software by representing a clear description about problem domain, approaches used and the solution.

**Que 1.14.** Write short note on management control.

**Answer**

1. Management control is described as a function that is aimed at achieving defined goals within a set timetable.
2. The process has three major components i.e., remedial action, measuring the actual performance, and setting standards.
3. The process includes comparing actual and planned performance, measuring the difference between the two, identifying the causes that have lead to the difference and taking corrective action to minimize or remove the difference.
4. It is the process through which the management of an organization influences other members to implement the strategies laid down by the company.
5. It can be a tool, process, policy, practice or a system that is put into place so that the management can direct the resources of its organization as per its wishes to achieve set targets.

**Que 1.15.** Explain different features of management control.

**Answer**

Following are the features of management control :

- 1. Behavioral consideration :**
  - a. The management aims to have a direct impact on the employees of its organization.
  - b. It adopts necessary strategies to influence their mindset and workings so that they start believing that their personal and professional goals are in tandem.

**2. Financial and non-financial performance :**

- a. These measures are developed as part of management control so that the management can make comparisons between actual performance and planned performance.

**3. Management control activities :**

- a. The management carries out its functions by influencing the individuals or groups to change their behavior so that it becomes easy to achieve set goals.

**PART-3**

*Project Portfolio Management, Cost-benefit Evaluation Technology, Risk Evaluation, Strategic Program Management, Stepwise Project Planning.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 1.16.** Explain project portfolio management in detail.

**Answer**

1. Project portfolio management (PPM) process defines how an organization approaches project prioritization, resource allocation, budgeting, scheduling, and other major project components.
2. The goal of PPM is to find the best possible combination of resources to help an enterprise achieve its objectives, and it takes into account such factors as external market conditions, customer demands, competitive environment, and government regulations.
3. Project portfolio management has become a key component in organizations as they look to enhance their ability to manage multiple projects in an efficient and effective way.
4. It provides all the visibility executives need to make informed decisions about anything related to projects.
5. Managing project portfolios ensures that an organization can leverage its project selection and execution success, according to the Project Management Institute (PMI).

**Que 1.17.** What are the objectives of PPM ?

**Answer**

Following are the objectives of PPM :

1. It creates a descriptive document, which contains vital information such as name of project, estimated timeframe, cost and business objectives.
2. The project needs to be evaluated on a regular basis to ensure that the project is meeting its target and stays in its course.
3. Selection of the team players, who will work towards achieving the project's objectives.

**Que 1.18.** What are the benefits of PPM ?

**Answer**

Following are the benefits of PPM :

1. Greater adaptability towards change.
2. Constant review and close monitoring brings about a higher return.
3. Management's perspectives with regards to project portfolio management is seen as an 'initiative towards higher return'. Therefore, this will not be considered to be a detrimental factor to work.
4. Identification of dependencies is easier to identify. This will eliminate some inefficiency from occurring.
5. Advantage over other competitors.
6. Helps to concentrate on the strategies, which will help to achieve the targets rather than focusing on the project itself.
7. The responsibilities of IT is focused on part of the business rather than scattered across several.

**Que 1.19.** What is cost-benefit analysis ?

**Answer**

1. Cost-benefit analysis (CBA) is a technique used to compare the total costs of a programme/project with its benefits, using a common metric.
2. This enables the calculation of the net cost or benefit associated with the programme.
3. It is used most often at the start of a programme or project when different options or courses of action are being appraised and compared, as an option for choosing the best approach.
4. It can also be used, to evaluate the overall impact of a programme in quantifiable and monetised terms.
5. CBA adds up the total costs of a programme or activity and compares it against its total benefits.

6. The technique assumes that a monetary value can be placed on all the costs and benefits of a programme, including tangible and intangible returns to other people and organisations in addition to those immediately impacted.
7. Advantage of cost-benefit analysis explicitly and systematically consider the various factors which should influence strategic choice.

**Que 1.20.** Write short note on cost-benefit evaluation techniques.

**Answer**

Following are the cost-benefit evaluation techniques :

1. **Net profit :** The net profit of a project is the difference between the total costs and the total income over the life of the project.
2. **Payback period :**
  - a. The payback period is the time taken to break even or payback the initial investment.
  - b. Project with the shortest payback period will be chosen on the basis that an organization will wish to minimize the time that a project is 'in debt'.
  - c. The advantage of the payback period is that it is simple to calculate and is not particularly sensitive to small forecasting errors.
  - d. Its disadvantage as a selection technique is that it ignores the overall profitability of the project; it totally ignores any income (or expenditure) once the project has broken even.
3. **Return on investment :**
  - a. The return on investment (ROI), also known as the accounting rate of return (ARR), provides a way of comparing the net profitability to the investment required.
  - b. It is used to calculate the return on investment, but a straightforward common version is :

$$\text{ROI} = \frac{(\text{Profit} - \text{Cost})}{\text{Cost}}$$

4. **Net present value :**

- a. The calculation of Net Present Value (NPV) is a project evaluation technique that takes into account the profitability of a project and the timing of the cash flows that are produced.

**Que 1.21.** What are the steps used in cost-benefit analysis ?

**Answer**

Following are the steps used in cost-benefit analysis :

**Step 1 : Specify the set of options :**

Identify a range of genuine, viable, alternative policy options to be analysed.

**Step 2 : Decide whose costs and benefits count :**

For most regulatory proposals, measuring the national costs and benefits is appropriate, rather than measuring any international impacts.

**Step 3 : Identify the impacts and select measurement indicators :**

- a. Identify the full range of impacts of each of the options.
- b. It is important to identify the incremental costs and benefits for each option, relative to the base case.

**Step 4 : Predict the impacts over the life of the proposed regulation :**

- a. The impacts should be quantified for each time period over the life of the proposed regulation.
- b. The total period needs to be long enough to capture all the potential costs and benefits.

**Step 5 : Monetise impacts :**

Assigning a net Rupee value of the gains and losses of a regulatory initiative for all people affected is one useful way to measure the effects of a proposed change.

**Step 6 : Discount future costs and benefits to obtain present values :**

The need to discount future cash flows can be viewed from two main perspectives, both of which focus on the opportunity cost of the cash flows implied by the regulation.

**Que 1.22.** Write a short note on risk management process.

**OR**

Write short note on risk analysis and risk control.

**Answer**

Risk management is a very tedious task. It involves basically two steps :

1. **Risk assessment :** It is the process of examining a project and identifying areas of potential risk. The risk assessment consists of three activities :

- a. **Risk identification :**

- i. Risk identification is a systematic attempt to specify threats to the project plan. The purpose of risk identification is to develop a list of risk items called risk statement.
- ii. Risk identification is carried out as a team process using brainstorming. To assist the process a list of risk types can be used.

- iii. The end product of this step of the process is a list of risks that could occur and affect the product, the process or the business.

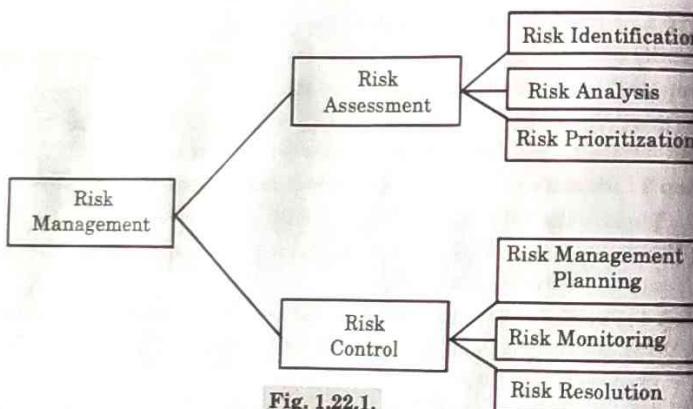


Fig. 1.22.1.

- iv. Within the identification phase, several activities occur. The main activities are :
1. **Identify risks :** A checklist is used as a tool for identification of risks.
  2. **Define risk attributes :** After the risks are identified, they are evaluated with the criteria : likelihood of occurrence (probability), consequence and time frame for action.
  3. **Document :** In this initial phase, the description of the risk issue, the probability and the consequence are specified in subjective terms.
  4. **Communicate :**
    - a. If projects have been conducted before, the resolution of these inputs may be stored in a database that helps the project managers to detect and find appropriate risk items.
    - b. The output of the identification phase is the risk statement that contains identified risks that may affect the project.
    - c. Furthermore, together with the statements, risk context is produced.
    - d. The purpose of the context is to describe the risk items events, conditions, constraints, assumptions, circumstances, contributing factors and related issues.

by answering the question what, when, where, how and why of each risk identified.

**b. Risk analysis :**

- i. The purpose of the risk analysis is to assess the loss probability and magnitude of each risk item.
- ii. The input is the risk statement and context developed in the identification phase.
- iii. The output of this phase is a risk list containing relative ranking of the risks and a further analysis of the description, probability, consequence and context.
- iv. The main activities in this phase are :
  1. **Group similar risks :** Detect duplicates and find new risk items by grouping the identified risks into categories.
  2. **Determine risk drivers :** The risk drivers are parameters that affect the identified risk.
  3. **Determine source of risks :** The sources of risks are the root causes of the risks.
  4. **Estimate risk exposure :** The risk exposure is measure of the probability and the consequence of a risk item.
  5. **Evaluate against criteria :** Each risk item is evaluated using the predefined criteria, which are important for the specific project.

**c. Risk prioritization :**

- i. Risk prioritization helps the project focus on its most severe risks by assessing the risk exposure.
- ii. Exposure is the product of the probability of incurring a loss due to the risk and the potential magnitude of that loss.

**2. Risk control :** Risk control is the process of managing risks to achieve the desired outcomes. Risk control process involves the following activities :

**a. Risk planning :**

- i. Risk management planning produces a plan for dealing with each significant risk, including mitigation approaches, owners, and time lines.

**b. Risk mitigation :**

- i. The risk mitigation is plan that would reduce or eliminate the highest risks.
- ii. The mitigation plan includes a description of the actions that can be taken to mitigate the red rated risk and assigns a primary handler for the action.

**c. Risk resolution :**

- i. Risk resolution is the execution of the plans for dealing with each risk.
- ii. If the risk is at the watch list, a plan of how to resolve the risk already had taken place. The project manager has to respond to the trigger and execute the action plan.

**d. Risk monitoring :**

- i. Risk monitoring is the continually reassessing of risks as the project proceeds and conditions change.

**Que 1.23.** What are the factors which affects the risk identification procedure of any software project ?

**Answer**

The categories of factors that will need to be considered include the following :

**1. Application factors :**

- a. The nature of the application, whether it is a simple data processing application, a safety-critical system or a large distributed system with real-time elements is likely to be a critical factor.
- b. The expected size of the application is also important because the larger the system, the greater is the likelihood of errors and communication and management problems.

**2. Staff factors :**

- a. The experience and skills of the staff involved are clearly major factors. An experienced programmer is less likely to make errors than one with little experience.
- b. Such factors as the level of staff satisfaction and the staff turn-over rates are also important to the success of any project. Demotivated staff or key personnel leaving unexpectedly have caused many a project to fail.

**3. Project factors :**

- a. It is important that the project and its objectives are well defined and that they are absolutely clear to all members of the project team and all key stakeholders.
- b. Similarly, an agreed and formal quality plan must be in place and adhered to by all participants. The possibility that quality plan is inadequate or not adhered to will jeopardize the project.

**Project methods :**

- a. Using well-specified and structured methods for project management and system development will decrease the risk of delivering a system that is unsatisfactory or late.

**Hardware/Software factors :**

- a. A project that requires new hardware for development is likely to pose a higher risk than one where the software can be developed on existing (and familiar) hardware.
- b. Where a system is developed on type of hardware or software platform to be used on another there might be additional (and high) risks at installation.

**Changeover factors :**

- a. Incremental or gradual changeover minimizes the risks involved but is not always practical.
- b. Parallel running can provide a safety net but might be impossible or too costly.

**Supplier factors :**

- a. The extent to which a project relies on external organizations that cannot be directly controlled often influences the project's success.

**Environment factors :** Changes in the environment can affect a project's success.

**Health and safety factors :** While not generally a major issue for software projects, the possible effects of project activities on the health and safety of the participants and the environment should be considered.

**Que 1.24.** Write short note on strategic program management.

**Answer**

Strategic program management means centralized way to coordinate program's strategic goals and objectives.

Program management has close contact to enterprise portfolio and strategic management.

In order to continuously improve and make strategic objectives achievable it's important to setup enterprise program management office.

A program manager is a strategic project-management professional whose job is to help oversee and coordinate the various projects, products, and other strategic initiatives across an organization.

There are five essential tasks of strategic management. They include developing a strategic vision and mission, setting objectives, crafting tactics to achieve those objectives, implementing and executing the tactics, and evaluating and measuring performance.

**Que 1.25.** What are the components which drive the project to its ultimate goal ?

**Answer****1. Strategic analysis :**

- a. This forms the basis for which projects an organisation chooses to undertake.
- b. Each project needs to link to the organisation's mission and be key to meeting long-term objectives.

**2. Strategic choice :**

- a. Managing multiple projects is a complex task, something that project managers do in their daily routine.
- b. But deciding on the 'right' projects is an important step which requires a strategic choice.
- c. It means identifying projects that meet the aspirations and expectations of stakeholders, while also playing to the company's strengths.
- d. There's also a need to identify and take advantage of external opportunities, while avoiding external threats.

**3. Strategic implementation :**

- a. Here, strategic project management sets out the long-, medium- and short-term goals for projects and programmes.
- b. Strategic implementation examines all kinds of benefits, including:
  - i. The use and benefits of collaborative tools in projects.
  - ii. How people and resources are assigned.
  - iii. The 'why?' of projects, not just at a base level, but from the top of a company.

**Que 1.26. | How to develop strategic project management ?****Answer****1. Simplify decision-making :**

- a. With a clear strategy before you, the decision-making process becomes easier as you always have the right base to guide your conclusions.

**2. Improve priority management :**

- a. Advance your strategy and your projects every day by developing a habit of starting with one important thing.

**3. Link budgets to strategy :**

- a. Allocating the required budget is a clear signal of the company's priorities.
- b. Therefore, the overall business strategy must play a vital role in all financial decisions when it comes to every project.

**4. Contribute to the project strategy :**

- a. Most of the high-performing companies call on their project management offices to contribute to strategic planning.
- b. Even if you're starting as a project manager and have limited input on the strategy today, you need to educate yourself and prepare when the time comes.

**5. Focus on organizational ambitions :**

- a. People want to be recognized and admired for their work, and that is the same in any branch, including project management.

**6. Revisit strategic progress :**

- a. Some businesses consider creating the strategy as nothing more than an annual thought exercise—they focus much energy and invest countless hours into developing the strategic documents.

**Que 1.27. | Write short note on software project planning.****Answer**

1. Project planning is an aspect of project management, which comprises of various processes.
2. The aim of these processes is to ensure that various project tasks are well coordinated and they meet the various project objectives including timely completion of the project.
3. The project plan reflects the current status of all project activities and is used to monitor and control the project.
4. Project planning is an ongoing effort throughout the project life cycle.
5. The project planning tasks ensure that various elements of the project are coordinated and therefore guide the project execution.
6. Project planning helps in :
  - a. Facilitating communication.
  - b. Monitoring/measuring the project progress.
  - c. Provides overall documentation of assumptions/planning decisions.
7. The project planning phases can be broadly classified as follows :
  - a. Development of the project plan.
  - b. Execution of the project plan.
  - c. Change control and corrective actions.
8. Project planning spans across the various aspects of the project. Generally project planning is considered to be a process of estimating, scheduling and assigning the projects resources in order to deliver an end product of suitable quality.
9. However, it is much more as it can assume a very strategic role, which can determine the success of the project.

**Que 1.28.** What are the different types of project planning ?

**Answer**

Following are the types of project planning :

**1. Project scope definition and scope planning :**

- a. In this step, we document the project work that would help us achieve the project goal.
- b. We document the assumptions, constraints, user expectations, business requirements, technical requirements, project deliverables, project objectives and everything that defines the final product requirements.

**2. Quality planning :**

- a. The relevant quality standards are determined for the project.
- b. Based on the inputs captured in the previous steps such as the project scope, requirements, deliverables, etc., various factors influencing the quality of the final product are determined.
- c. The processes required to deliver the product as promised and as per the standards are defined.

**3. Project activity definition and activity sequencing :**

- a. In this step, we define all the specific activities that must be performed to deliver the product by producing the various product deliverables.
- b. The project activity sequencing identifies the interdependence of all the activities defined.

**4. Time, effort and resource estimation :**

- a. Once the scope, activities and activity interdependence is clearly defined and documented, the next crucial step is to determine the effort required to complete each of the activities.
- b. The effort can be calculated using one of the many techniques available such as function points, lines of code, complexity of code, benchmarks, etc.

**5. Risk factors identification :**

- a. It is important to identify and document the risk factors associated with the project based on the assumptions, constraints, user expectations, specific circumstances, etc.

**6. Schedule development :**

- a. The time schedule for the project can be arrived on the basis of the activities, interdependence and effort required for each of them.
- b. The schedule may influence the cost estimates and the cost benefit analysis.

- c. Popular tools can be used for creating and reporting the schedules such as Gantt charts.

**Cost estimation and budgeting :**

- a. Based on the information collected in all the previous steps, it is possible to estimate the cost involved in executing and implementing the project.
- b. A cost benefit analysis can be arrived at for the project.
- c. Based on the cost estimates, budget allocation is done for the project.

**Organizational and resource planning :**

- a. Based on the activities identified, schedule and budget allocation resource types and resources are identified.
- b. The goals of resource planning is to ensure that the project is run efficiently.
- c. Resource planning is an iterative process and necessary to optimize the use of resources throughout the project life cycle thus making the project execution more efficient.
- d. There are various types of resources : equipment, personnel, facilities, money, etc.

**Risk management planning :**

- a. Risk management is a process of identifying, analyzing and responding to a risk.
- b. Based on the risk factors, identified risk resolution plan is created.
- c. The plan analyses each of the risk factors and their impact on the project. The possible responses for each of them can be planned.

**10. Project plan development and execution :**

- a. Project plan development uses the inputs gathered from all the other planning processes such as scope definition, activity identification, activity sequencing, quality management planning, etc.
- b. A detailed work breakdown structure comprising of all the activities identified is used.
- c. The tasks are scheduled based on the inputs captured in the steps previously described.
- d. The project plan documents all the assumptions, activities, schedule, timelines and drives the project.

**11. Performance reporting :**

- a. The progress of each of the tasks/activities described in the project plan is monitored.
- b. The progress is compared with the schedule and timelines documented in the project plan.

- c. Various techniques are used to measure and report the project performance such as EVM (Earned Value Management).
  - d. A wide variety of tools can be used to report the performance of the project such as PERT charts, Gantt charts, Logical bar charts, Histograms, Pie charts, etc.
- 12. Planning change management :**
- a. Analysis of project performance can necessitate that certain aspects of the project be changed.
  - b. The requests for changes need to be analyzed carefully and its impact on the project should be studied.
  - c. Considering all these aspects the project plan may be modified to accommodate this request for change.

**Que 1.29.** What are the activities performed during software project planning ?

**Answer**

Following activities are performed during software project planning :

1. Ownership of customer relationship and business.
2. Analysis of project health (productivity and profitability) and report to business manager.
3. Managing the onsite team.
4. Maintain the consolidated delivery and billing plan.
5. Identification and planning of new business with the customer.
6. Review of estimates and proposals.
7. Provide manpower requirements.
8. Maintain the project management plan.



## Project Life Cycle and Effort Estimation

### CONTENTS

- |                 |  |                       |
|-----------------|--|-----------------------|
| <b>Part-1 :</b> | <b>Software Process and Process Models, Choice of Process Models, Rapid Application Development</b>  | <b>2-2K to 2-15K</b>  |
| <b>Part-2 :</b> | <b>Agile Methods, Dynamic System Development Method, Extreme Programming, Managing Interactive Processes</b>   | <b>2-15K to 2-20K</b> |
| <b>Part-3 :</b> | <b>Basics of Software Estimation, Effort and Cost Estimation Techniques, COSMIC Full Function Points, COCOMO II, a Parametric Productivity Model</b> | <b>2-20K to 2-28K</b> |

**PART - 1**

*Software Process and Process Models, Choice of Process Models,  
Rapid Application Development.*

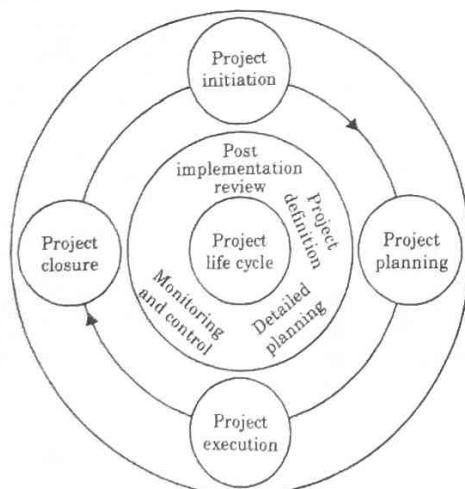
**Questions-Answers**

**Long Answer Type and Medium Answer Type Questions**

**Que 2.1.** Describe project management life cycle.

**Answer**

The project management life cycle comprises of four phases :

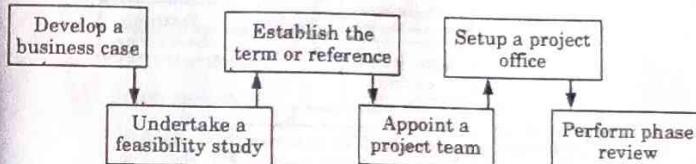


**Fig. 2.1.1.**

**1. Project initiation :**

- a. Project initiation is the first phase in the project life cycle which involves starting up the project.
- b. Initiate a project by defining its purpose and scope, the justification for initiating it and the solution to be implemented.

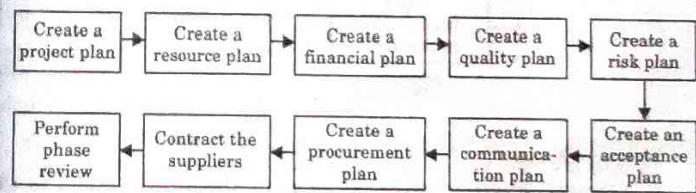
- c. The project initiation phase involves the following six key steps which are shown in Fig. 2.1.2.



**Fig. 2.1.2.**

**2. Project planning :**

- a. After defining the project and appointing the project team, we are ready to enter the detailed project planning phase.
- b. This involves creating a suite of planning documents to help guide the team throughout the project delivery.
- c. The planning phase involves completing the following ten key steps as shown in Fig. 2.1.3.



**Fig. 2.1.3.**

**3. Project execution :**

- a. This is the phase in which the deliverables are physically built and presented to the customer for acceptance.
- b. These processes include managing time, cost, quality, change, risks, issues, suppliers, customers and communication.
- c. Once all the deliverables have been produced and the customer has accepted the final solution, the project is ready for closure.

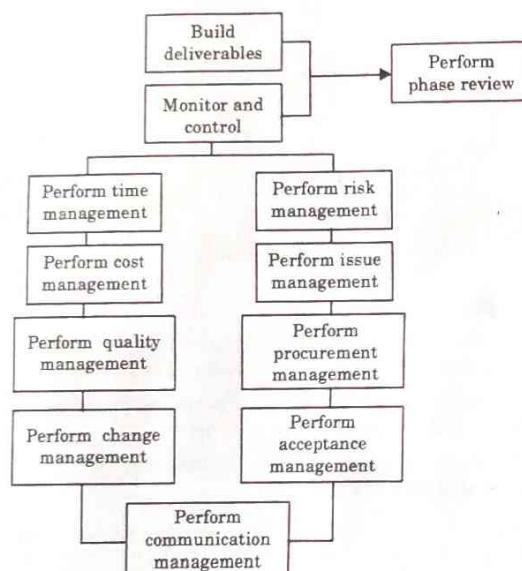


Fig. 2.1.4.

**4. Project closure :**

- Project closure involves releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources and communicating project closure to all stakeholders.

**Que 2.2. Explain software process model in detail.****Answer**

- A software process model is an abstraction of the actual process, which is being described. It can also be defined as a simplified representation of a software process.
- Each model represents a process from a specific perspective.
- Basic software process models on which different type of software process models can be implemented are as follows :
  - A workflow Model :** It is the sequential series of tasks and decisions that make up a business process.

- The Waterfall Model :** It is a sequential design process in which progress is seen as flowing steadily downwards. Phases in waterfall model includes :
  - Requirements Specification
  - Software Design
  - Implementation
  - Testing
- Dataflow Model :** It is diagrammatic representation of the flow and exchange of information within a system.
- Evolutionary Development Model :** Following activities are considered in this model :
  - Specification
  - Development
  - Validation
- Role / Action Model :** Roles of the people involved in the software process and the activities are included in this model.

**Que 2.3. Discuss SDLC model in brief.****Answer****Software Development Life Cycle (SDLC) :**

- It is a diagrammatic representation which also provides description of various phases and their sequence in life cycle of software product.
- Software undergoes some basic stages during its life cycle i.e., requirement analysis and specification, design, coding, testing and maintenance.
- There are many software models which are used as per requirement of software product.
- All models undergo these basic stages while their mapping of the stages may be different as per model requirement.
- We can choose any one of model on the basis of :
  - Development speed
  - Product quality
  - Project visibility
  - Administrative overhead
  - Risk exposure

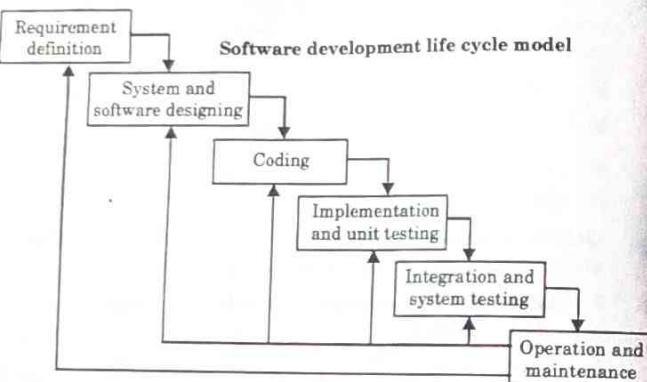


Fig. 2.3.1.

**Phases of software development life cycle models :**

1. Requirement definition (system analysis and system specification)
2. System and component (software) design
3. Coding
4. Implementation and unit testing
5. Integration and system testing
6. Operation and maintenance

**Que 2.4.** Write short note on waterfall model.

**Answer**

1. Waterfall model is also known as classical, traditional, conventional or linear segment model.
2. It focus on sequential phase development in which no phase can overlap another phase and so the developer must complete each phase before starting next phase.
3. Each phase of this model has a well defined starting and ending criteria which is to be documented by which the standard outputs (deliverables) to be produced by each phase can formulate.
4. This model does not allow to go back to the previous stage from one stage "one way street with no turning back" like waterfall that's why it is called waterfall model.

**Que 2.5.** Explain different phases of waterfall model.

**Answer**

The different phases of waterfall model are :

- 1. Feasibility study :**
  - a. This phase is used to check whether the new proposed system is economically, technically and operationally feasible or not.
  - b. In which information is gathered about what output to be produce, input required and process that can be used and then different solution strategies are formulated.
- 2. Requirement analysis and specification :**
  - a. This phase give specification about what is the system for.
  - b. This phase analyze and specifies the requirement of user/customer and document them properly.
  - c. In requirement analysis, the data are gathered from users using different methods such as interviews, questionnaires, on site observation and through written document of the organization.
  - d. Finally, the requirements are organized systematically in the form of document called software requirement specification (SRS) document.
- 3. System and software designing phase :**
  - a. In design phase, overall structure or architecture is developed which is transformation of requirement specified in SRS.
- 4. Coding and module testing :**
  - a. In this phase, system design is translated into source code also called program code.
  - b. End product of coding phase is module testing, in which each module is tested individually whether they are working properly or not, this is also called unit testing.
  - c. The output of this phase is programmed module.
- 5. Integration and system testing :**
  - a. According to plan, individually tested module are integrated to develop the system.
  - b. In this phase, all the module are not joined together to form the system rather than it is done in various steps and during these steps the partially integrated system is tested and then the next module added to it and again the testing is done.
  - c. The output of this phase is testing and integration report.

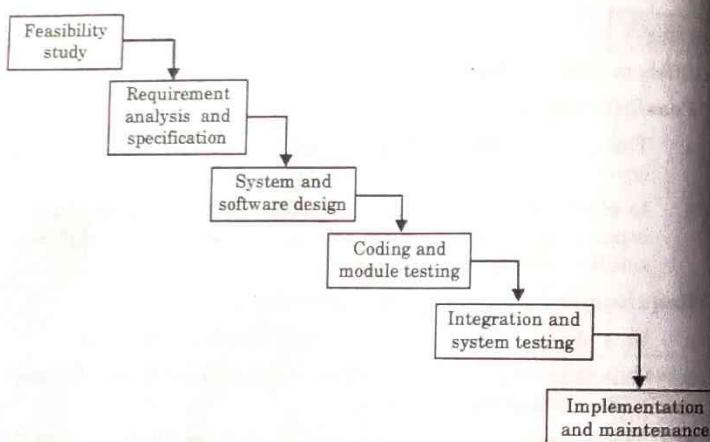


Fig. 2.5.1.

**6. Implementation/Installation and maintenance :**

- In this phase, system is installed at the user end and it is checked. If there is any upgradation required in hardware or software element at user end that is made available.

**Que 2.6. What are the advantages and disadvantages of waterfall model ?**

**Answer**

Following are the advantages and disadvantages of waterfall model :

**Advantages of waterfall model :**

- Easy to understand.
- Each stage has well defined input and output.
- Helps in project planning.
- It provides a template into which models for analysis, design, code, test and support can be placed.
- It provides structure to a technically weak or inexperienced staff.

**Disadvantages of waterfall model :**

- Iteration not possible as it is one way street.
- Requirements freezing at starting stage.
- No stage can start until the previous stage is completed.
- A rigid model.
- Difficulty in accommodating changes after project development.

- Customer gets opportunity very late to review the project so less user involvement during development process.

**Que 2.7. What is prototyping model ? When it is used ?**

**Answer**

**Prototype model :**

- There are certain drawbacks in waterfall model.
- This model is developed to overcome two main drawbacks of waterfall model.
- They are :
  - Difficult to predict how the new system will be.
  - Difficulty in predicting the entire requirements at very beginning of project, because even end user doesn't know all requirements initially.

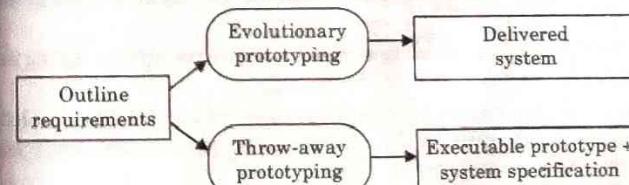


Fig. 2.7.1.

- In prototype model, firstly a working prototype is developed instead of developing actual software.
- This is developed according to available requirements which basically have limited functions, low reliability while it passes through all stages of development i.e., design, coding, testing but is done formally.
- This model is used by developer and given to user for review which helps the user to better understand his need and requirement and then feedback from user is collected and given to developer that helps to remove uncertainties in the requirements of the software.
- Prototype modeling is of two types :
  - Evolutionary/Exploratory prototyping
  - Throw-away prototyping

**Que 2.8. Explain V-process model.**

**Answer**

- Fig. 2.8.1 shows a diagrammatic representation of V-process model.

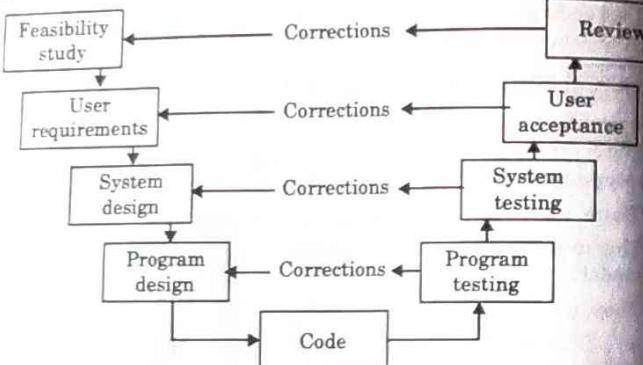


Fig. 2.8.1.

2. This is an elaboration of the waterfall model and stresses the necessity for validation activities that match the activities that create the products of the project.
3. The V-process model can be seen as expanding the activity testing in the waterfall model.
4. Each step has a matching validation process which on finding the defects causes a loop back to the corresponding development stage and a reworking of the following steps.
5. This feedback should only occur where a discrepancy has been found between what was specified by a particular activity and what was actually implemented in the next lower activity on the descent of the V loop.

**Que 2.9.** Write short note on spiral model.

**Answer**

1. The activities of this model are organized like a spiral that has many circles whose number depends on software requirement.
2. The radial dimension of this model, the cumulative cost for accomplishing different stages (phases) and angular dimension show the progress in completing each cycle of the spiral.
3. The main objective of this model is to minimize the risk through the use of prototype. This model is mainly used for large projects.
4. The spiral model can said to be made up of waterfall model in which each stage is preceded by risk analysis.
5. Its main feature is risk avoidance rather than documentation or code.
6. This model is more flexible than any other model as number of phases through which the product will be developed is not fixed, it depends on software requirement.

7. The two basic step of this model are :
  - a. Identify the sub-problem which is having highest risk.
  - b. Find solution for that particular problem (risk).
8. Each phase of this model is split into four quadrant (sections) having specific functions :
  - a. In the first quadrant, we do identification of objectives; find out different alternative for achieving the objective and present constraints.

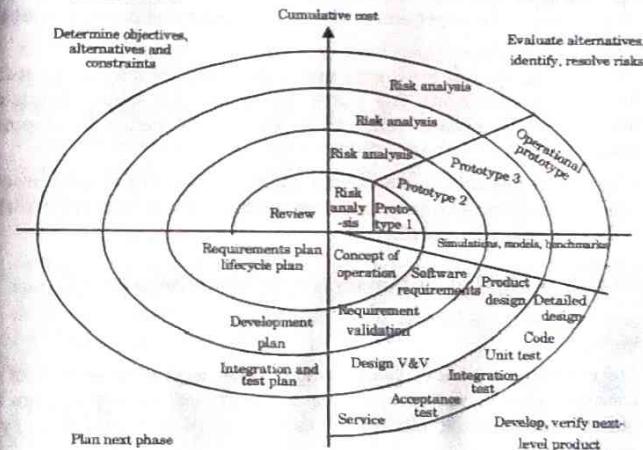


Fig. 2.9.1.

- b. In the second quadrant, we evaluate these alternatives on the basis of objective and constraints. The main focus in this step is given on evolution of alternative on the basis of risk as risk causes the chances of unmet objectives.
- c. In the third quadrant, project development and validation is carry out.
- d. In the fourth quadrant, the project is reviewed and decision is made up whether to continue with a further loop of spiral or not. If it is decided to continue, the project plan is drawn up for the next phase of project.

**Que 2.10.** Discuss incremental life cycle model in brief.

**Answer**

1. The incremental life cycle model is similar to the waterfall in many respects, but it differs in that it produces some tangible results to the customer sooner.

2. The initial processes of system requirements and feasibility, software requirements and general design are done in sequence, once for the overall project.
3. A partitioning into increments then occurs, where a number of different development efforts, beginning with detailed design are identified.
4. These increments can be planned as sequential or parallel efforts, depending upon the project characteristics and project constraints.
5. For the same reason as the waterfall model, incremental life cycle model is suitable for large projects with requirements that are known, stable and understood.
6. When requirements are known and understood but may not be stable, the incremental model is a logical choice because later releases can incorporate changes in that surface during the earlier development efforts.
7. Use of this model requires careful partitioning of the system/product and well defined interfaces between the increments, especially if they will be developed in parallel.

**Que 2.11.** Discuss evolutionary life cycle model in brief.

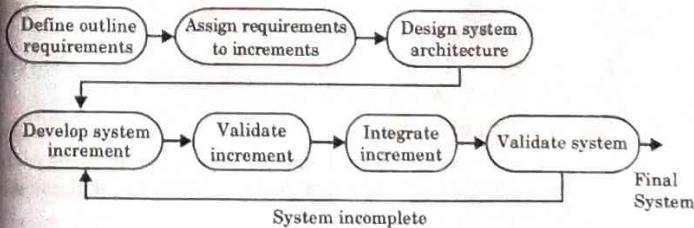
**Answer**

1. The evolutionary life cycle model applies in sequential aspects of the waterfall model, and partitioning of the project borrowed from the incremental model, but adds the evolution or the discovery of requirements.
2. Evolutionary life cycle model is preferable life cycle model when requirements are not fully known, but a subset of the requirements is known, stable and understood.
3. Benefits include the early delivery of some functions and the early testing of some assumptions before the entire system is built around them.
4. The major weakness of this model is related to the inability to plan in detail at the outset of the project.
5. Because the requirements are not fully known, problems with the scope creep, inaccurate estimating and less than optimal architecture are possible.
6. The predominately sequential nature of this life cycle makes it not particularly rapid or cost efficient for complex systems.
7. Project managers using the evolutionary model must plan to revise the overall architecture as the system evolves.

**Que 2.12.** Explain iterative enhancement model in brief.

**Answer**

1. The classical waterfall model work on the concept that once the requirements are specified, no further change will require in any phase of life cycle of product.
2. Iterative model is developed to overcome this drawback of waterfall model.
3. It is a combination of benefits of waterfall and prototype model.
4. In this model, software is developed in increment; each increment adds some functional capability to the system until full system is developed.
5. It provide better testing result as testing after each increment is easy as compare to entire model testing of waterfall model.
6. Prototyping used in this model help in identifying the system requirements.
7. In this model, a partial product is developed on few easily understandable requirements of overall requirements, and then a project control list is developed which contain the entire task which have to be performed in final implementation.
8. This helps in finding out how far the product is from final product.
9. In this model, developer themselves provide specification, so they have good control over system development.



**Fig. 2.12.1.** Iterative enhancement model.

**Que 2.13.** Discuss Rapid Application Development (RAD) model.

**Answer**

1. Rapid application development (RAD) is an incremental software development process model that emphasizes an extremely short development cycle.

2. The RAD model is a "high-speed" adaptation of the linear sequential model in which rapid development is achieved by using component based construction.
3. If requirements are well understood and project scope is constrained the RAD process enables a development team to create a "fully functional system" within very short time periods.
4. Used primarily for information systems applications, the RAD approach encompasses the following phases :
  - a. **Business modeling :** The information flow among business functions is modeled in a way that answers the following questions
    - i. What information drives the business process ?
    - ii. What information is generated ?
    - iii. Who generates it ?
    - iv. Where does the information go ?
    - v. Who processes it ?
  - b. **Data modeling :**
    - i. The information flow defined as part of the business modeling phase is refined into a set of data objects that are needed to support the business.
    - ii. The characteristics (called attributes) of each object identified and the relationships between these objects are defined.
  - c. **Process modeling :**
    - i. The data objects defined in the data modeling phase are transformed to achieve the information flow necessary to implement a business function.
    - ii. Processing descriptions are created for adding, modifying, deleting, or retrieving a data object.
  - d. **Application generation :**
    - i. RAD assumes the use of fourth generation techniques rather than creating software using conventional third generation programming languages.
    - ii. The RAD works to reuse existing program components (when possible) or create reusable components (when necessary).
    - iii. In all cases, automated tools are used to facilitate construction of the software.
  - e. **Testing and turnover :**
    - i. Since the RAD process emphasizes reuse, many of the program components have already been tested. This reduces overall testing time.

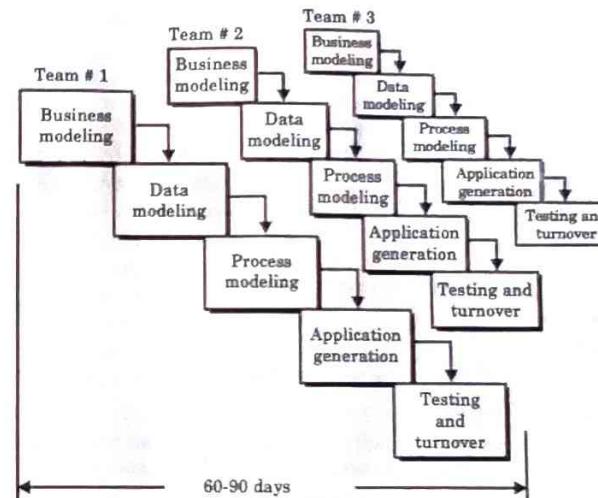


Fig. 2.13.1.

**PART-2**

*Agile Methods, Dynamic System Development Method, Extreme Programming, Managing Interactive Processes.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 2.14.** Write short note on Agile methods.

**Answer**

1. Agile method refers to a software development approach based on iterative development.
2. Agile methods break tasks into smaller iterations that do not directly involve long term planning.
3. The project scope and requirements are laid down at the beginning of the development process.
4. Plans regarding the number of iterations, the duration and the scope of each iteration is clearly defined in advance.

5. Each iteration is considered as a short time "frame" in the Agile process model, which typically lasts from one to four weeks.
6. The division of the entire project into smaller parts helps to minimize the project risk and to reduce the overall project delivery time requirements.
7. Each iteration involves a team working through a full software development life cycle including planning, requirements analysis, design, coding, and testing before a working product is demonstrated to the client.

**Que 2.15.** What are the phases of Agile model ?

**Answer**

Following are the phases in the Agile model :

1. **Requirements gathering :**
  - a. In this phase, we define the requirements, explain business opportunities and plan the time and effort needed to build the project.
  - b. Based on this information, we can evaluate technical and economic feasibility.
2. **Design the requirements :**
  - a. When we have identified the project, work with stakeholders to define requirements.
  - b. We can use the user flow diagram or the high-level UML diagram to show the work of new features and show how it will apply to the existing system.
3. **Construction / iteration :**
  - a. When the team defines the requirements, the work begins.
  - b. Designers and developers start working on their project, which aims to deploy a working product.
  - c. The product will undergo various stages of improvement, so it includes simple, minimal functionality.
4. **Testing :** In this phase, the Quality Assurance team examines the product's performance and looks for the bug.
5. **Deployment :** In this phase, the team issues a product for the user's work environment.
6. **Feedback :** In this, the team receives feedback about the product and works through the feedback.

**Que 2.16.** Explain different Agile testing methods.

**Answer**

Following are different agile testing methods :

1. **SCRUM :**
  - a. It is an agile development process focused primarily on ways to manage tasks in team-based development conditions.
  - b. There are three roles in it, and their responsibilities are :
    - i. **Scrum Master :** The scrum can set up the master team, arrange the meeting and remove obstacles for the process.
    - ii. **Product owner :** The product owner makes the product backlog, prioritizes the delay and is responsible for the distribution of functionality on each repetition.
    - iii. **Serum Team :** The team manages its work and organizes the work to complete the sprint or cycle.
2. **Extreme Programming (XP) :** This type of methodology is used when customers are constantly changing demands or requirements, or when they are not sure about the system's performance.
3. **Crystal :** There are three concepts of this method :
  - a. **Chartering :** Multi activities are involved in this phase such as making a development team, performing feasibility analysis, developing plans, etc.
  - b. **Cyclic delivery :** Cyclic delivery involves the following task :
    - i. Team updates the release plan.
    - ii. Integrated product delivers to the users.
  - c. **Wrap up :** According to the user environment, this phase performs deployment, post-deployment.
4. **Dynamic Software Development Method (DSDM) :**
  - a. DSDM is a rapid application development strategy for software development and gives an agile project distribution structure.
  - b. The essential features of DSDM are that users must be actively connected, and teams have been given the right to make decisions.
  - c. The techniques used in DSDM are :
    - i. Time Boxing
    - ii. MoSCoW Rules
    - ii. Prototyping

**Que 2.17.** What are the advantages and disadvantages of Agile method ?

**Answer**

**Advantages of Agile method :**

1. Frequent delivery.
2. Face-to-Face communication with clients.
3. Efficient design and fulfills the business requirement.
4. Changes are acceptable.
5. It reduces total development time.

**Disadvantages of Agile Model :**

1. Due to the shortage of formal documents, it creates confusion and crucial decisions taken throughout various phases can be misinterpreted at any time by different team members.
2. Due to the lack of proper documentation, once the project completes and the developers allotted to another project, maintenance of the finished project can become a difficulty.

**Que 2.18. | What do you understand by Software Configuration Management (SCM) ? Explain its goal.**

**Answer**

1. Software Configuration Management (SCM) is one of the foundations of software engineering. It is used to track and manage the emerging product and its versions.
2. This is to assure quality of the product during development and operational maintenance of the product.
3. SCM ensures that all people involved in the software process know what is being designed, developed, built, tested, and delivered.
4. Software Configuration Management (SCM) can be defined as a process of defining and implementing a standard configuration, which results into the primary benefits such as easier setup and maintenance, less down-time, better integration with enterprise management, and more efficient and reliable backups and also maximize productivity by minimizing mistakes.

**Goals of software configuration management :**

1. Software configuration management activities are planned.
2. Selected software work products are identified, controlled, and available.
3. Changes to identified software work products are controlled.
4. Affected groups and individuals are informed of the status and content software baselines.

**Que 2.19. | What are the objectives of software configuration management ?**

**Answer**

**Objectives of software configuration management are :**

1. **Remote system administration :**
  - a. The configuration standard should include necessary software and/or privileges for remote system administration tools.
  - b. A remote administration client, that is, correctly installed and configured on the client side is the cornerstone of the remotely administered network.
  - c. These remote tools can be used to check the version of virus protection, check machine configuration, or offer remote help-desk functionality.
2. **Reduced user down-time :**
  - a. A great advantage of using a standard configuration is that system becomes completely interchangeable resulting in reduced user down-time.
  - b. If a given system experiences an unrecoverable error, an identical new system can be dropped into place.
3. **Reliable data backups :**
  - a. Using a standard directory for user data allows backup systems to selectively backup a small portion of a machine, greatly reducing the network traffic and memory usage for backup systems.
  - b. Also, should a catastrophic failure occur, the data directory could be restored to a new machine with little time and effort.
4. **Easy workstation setup :**
  - a. Any sort of standardized configuration streamlines the process of setting up the system and ensures that vital components are available.
  - b. If multiple machines are being setup according to a standard setup, most of the setup and configuration can be automated.
5. **Multi-user support :**
  - a. The system configuration is designed to allow multiple users to use the same workstation without interfering each other's work.
6. **Remote software installation :**
  - a. Most modern software packages are installed in factory pre-defined directories. While software installed in the manner will function correctly for a single user, it will lead to non-uniform configuration among a collection of machines.

- b. A good configuration standard will have software installed in specified directory areas to logically divide software on the disk.
- c. This will lead to easier identification of installed components and the possibility of automating installation procedures through the use of universal scripts.

**PART-3**

*Basics of Software Estimation, Effort and Cost Estimation Techniques, COSMIC Full Function Points, COCOMO II, a Parametric Productivity Model.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 2.20.** What do you mean by software project estimation ?

**Answer**

1. While computing the cost of project, one of the major components is the cost of effort applied by skilled software professionals in terms of person hours, person days or person-months.
2. Other factors which contribute to total cost are cost of hardware and software, traveling, cost of tools, training etc.
3. Hence, key to accurate estimation of cost is accurate estimation for the manpower that in turn also decides the team size.
4. Estimation of size of the software to be developed is also very important as it forms the basis for effort and schedule estimation.
5. A number of estimation methods to measure size in terms of number of lines of code, function points, object points etc. are proposed.
6. Software effort estimation is important because of following reasons :
  - a. Organizations have proper control over project and they can plan systematically.
  - b. There is a clear understanding of the product.
  - c. Estimation also determines the project feasibility in terms of budget and time constraints.
  - d. It helps in identification of resources to be used during the project.
  - e. Estimation also helps management in taking decision for current as well as future projects.

- f. Estimation helps in quantifying the impact of risks and guides the project manager to take suitable decision.

**Que 2.21.** Discuss various software project estimation techniques.

**Answer**

Following are the software project estimation techniques :

**1. Algorithmic cost modeling :**

- a. This approach is based on historical cost information.
- b. In this, a model is developed which relates the project cost to some software metric which is usually the size in this case.
- c. The most common size metric is the number of Lines of Code (LOC) of the final product but that is not easy to predict in the beginning.
- d. Code size based estimation is also uncertain because number of factors contributes for computing the final number of LOC, for example, hardware used, software choice, type of DBMS used etc.

**2. Expert judgment :**

- a. In this approach, experience and judgment of one or more experts on that particular application domain is used for the project estimation by extrapolating expert's experience.
- b. Each of the expert estimates the project cost and final cost estimation is decided by consensus.
- c. The problem with this technique is the limited expertise of the experts and hence should be used when other options are not available.

**3. Estimation by analogy :**

- a. This technique is used when the organization in the past have completed the projects of the similar nature.
- b. In this technique, comparisons are made with the past projects and estimates are proposed.

**4. Parkinson's law :**

- a. According to Parkinson's law, work expands to fill the available time and budget.
- b. It means that the Parkinson's approach to cost estimation assumes that the time for completion and available resources are known prior to starting the project.
- c. As a result, in some cases it can also result into over estimates.

**5. Pricing to win approach :**

- a. In the pricing to win approach, cost of the project is proportional to the budget of the customer.

- b. As a result, the estimated effort does not only depend upon the software functionality but also on the customer's capability to spend.
  - c. This approach, therefore often results into poor quality product schedule overrun and over budgeting.
- 6. Top-down estimation :**
- a. In this approach, the whole project is decomposed into number of phases/tasks and estimation for each phase is done using different approach.
  - b. In top-down estimation, whole functionality of the product is decomposed into sub-functions and cost estimation is done by using these logical sub-functions.
  - c. It is therefore suitable for using early in software life cycle.
- 7. Bottom-up estimation :**
- a. In this approach, instead of logical functions, components implementing these functions are used for cost estimation.
  - b. Each component cost is estimated and then added to give the final cost estimate.
  - c. Bottom-up estimation techniques are appropriate at detailed stages of project planning.

**Que 2.22. What are the different cost estimation techniques ?****Answer**

Folowing are different cost estimation techniques :

**1. Empirical Estimation Technique :**

- a. Empirical estimation is a technique or model in which empirically derived formulas are used for predicting the data that are required and are essential part of the software project planning step.
- b. These techniques are usually based on the data that is collected previously from a project and also based on some guesses, prior experience with the development of similar types of projects, and assumptions.
- c. It uses the size of the software to estimate the effort.
- d. In this technique, an educated guess of project parameters is made. Hence, these models are based on common sense.

**2. Heuristic Technique :**

- a. The heuristic technique is a technique or model that is used for solving problems, learning, or discovery in the practical methods which are used for achieving immediate goals.
- b. These techniques are flexible and simple for taking quick decisions through shortcuts and good enough calculations, most probably

- when working with complex data. But the decisions that are made using this technique are necessary to be optimal.
  - c. In this technique, the relationship among different project parameters is expressed using mathematical equations.
  - d. The popular heuristic technique is given by Constructive Cost Model (COCOMO). This technique is also used to increase or speed up the analysis and investment decisions.
- 3. Analytical Estimation Technique :**
- a. Analytical estimation is a type of technique that is used to measure work.
  - b. In this technique, firstly the task is divided or broken down into its basic component operations or elements for analyzing.
  - c. Second, if the standard time is available from some other source, then these sources are applied to each element or component of work.
  - d. Third, if there is no such time available, then the work is estimated based on the experience of the work.
  - e. In this technique, results are derived by making certain basic assumptions about the project.
  - f. Halstead's software science is based on analytical estimation model.

**Que 2.23. What are the advantages and disadvantages of Heuristic techniques ?****Answer****Advantages :**

1. In this method, practically staff learns by doing everything. The staff should behave like a researcher and he endeavours to find answers to questions.
2. Heurists believe that staff should be told as little as possible. They are to be led to find out more and more.
3. The method initiates activity. Also it involves activity of mind. The staff becomes an active discoverer of truth when they are forced to such situations by the seniors. The more active and attentive an individual, the more fully and firmly does he grasp knowledge.
4. In being considered as discoverers, staff takes delight and they perform work with much sincerity and pleasure.
5. This method turns out inquisitive and enquiring staff.

**Disadvantage :**

1. This method is ideal one; but fails for want of good equipment, due to insufficient staff.

2. Heuristic method is an expensive system.
3. Amount of work done under this system is very small.

**Que 2.24.** Write short note on COSMIC function points.

**Answer**

1. COSMIC function points are a unit of measure of software functional size.
2. The size is a consistent measurement (or estimate) which is very useful for planning and managing software and related activities.
3. The process of measuring software size is called Functional Size Measurement (FSM).
4. COSMIC functional size measurement is applicable to business, real-time and infrastructure software at any level of decomposition (from a whole software system down to a single re-usable component or a user story).
5. It is independent of the technology or processes used to develop the system. It is an ISO standard.
6. The unit of size is the COSMIC Function Point or CFP.

**Que 2.25.** Give various estimation models. Describe any one of the estimation model using suitable examples.

**Answer**

Various estimation models are :

**COCOMO model :**

1. COCOMO (COst constructive COst estimation MOdel) can be classified into one of the following three categories based on the development complexity : organic, semidetached, and embedded :
  - a. **Organic** : We can consider a development project to be of organic type, if the project deals with developing a well-understood application program, the size of the development team is reasonably small, and the team members are experienced in developing similar types of projects.
  - b. **Semidetached** : A development project can be considered to be of semidetached type, if the development team consists of a mixture of experienced and inexperienced staff. Team members may have limited experience on related systems but may be unfamiliar with some aspects of the system being developed.
  - c. **Embedded** : A development project is considered to be of embedded type, if the software being developed is strongly coupled to complex hardware, or if stringent regulations on the operational procedures exist.

According to Boehm, software cost estimation should be done through three stages : Basic COCOMO, Intermediate COCOMO, and Detailed/ Complete COCOMO.

**Basic COCOMO model :**

The basic COCOMO model gives an approximate software development efforts and cost as function of program size expressed in estimated lines of code.

The basic COCOMO estimation model is given by the following expressions :

$$\text{Effort } (E) = a * (\text{KLOC})^b$$

$$\text{Development Time } (T_{\text{dev}}) = c * (E)^d$$

Where E is effort applied in person-month,  $T_{\text{dev}}$  is development time in months.

- ii. The coefficients a, b, c, d are constant and can be calculated by given table :

Project	a	b	c	d
Organic	2.4	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

- iv. When effort and development time are known, the average staff size to complete the project may calculated as :

$$\text{Average staff size } (SS) = E / T_{\text{dev}} \text{ persons}$$

- v. When project size is known, the productivity level may be calculated as :

$$\text{Productivity } (P) = \text{KLOC}/E$$

**Intermediate COCOMO :**

- i. The intermediate COCOMO model recognizes this fact and refines the initial estimate obtained through the basic COCOMO expressions by using a set of fifteen cost drivers (multipliers) based on various attributes of software development.

- ii. For example, if modern programming practices are used, the initial estimates are scaled downwards by multiplication with a cost driver having a value less than one.

- iii. In general, the cost drivers can be grouped into four categories :

1. **Product attributes :** The characteristics of the product that are considered include the inherent complexity of the product (CPLX), reliability requirements of the product (RELY) and database size (DATA).

2. **Computer attributes :** The characteristics of the computer that are considered include execution time constraints (TIME), main storage constraints (STOR), virtual machine volatility (VIRT) and computer turnaround time (TURN).
  3. **Personnel :** The attributes of development personnel that are considered include the analyst capability (ACAP), application experience (AEXP), programmer capability (PCAP), virtual machine experience (VEXP) and programming language experience (LEXP).
  4. **Project attribute :** The characteristics of the project that are considered includes modern programming practices (MODP), use of software tools (TOOL) and required development schedule (SCED).
- iv. The intermediate COCOMO equations are :
- $$\text{Effort } (E) = a * (\text{KLOC})^b * \text{EAF}$$
- $$\text{Development Time } (T_{\text{dev}}) = c * (E)^d$$
- v. The EAF (Effort Adjustment Factor) is multiplication of different types of cost drivers.  $E$  is an effort applied in person-month;  $T_{\text{dev}}$  is development time in months.
- vi. The coefficients  $a$ ,  $b$ ,  $c$ ,  $d$  are constant and can be calculated by given table :

Project	a	b	c	d
Organic	3.2	1.05	2.5	0.38
Semidetached	3.0	1.12	2.5	0.35
Embedded	2.8	1.20	2.5	0.32

c. **Detailed/complete COCOMO model :**

- i. A major shortcoming of both the basic and the intermediate COCOMO models is that they consider a software product as a single homogeneous entity.
- ii. However, most large systems are made up of several smaller subsystems. These subsystems may have widely different characteristics.
- iii. For example, some subsystems may be considered as organic type, some semidetached, and some embedded.
- iv. Not only that the inherent development complexity of the subsystems may be different, but also for some subsystems the reliability requirements may be high, for some the development team might have no previous experience of similar development and so on.

- v. The complete COCOMO model considers these differences in the characteristics of the subsystems and estimates the effort and development time as the sum of the estimates for the individual subsystems.
- vi. The cost of each subsystem is estimated separately. This approach reduces the margin of an error in the final estimate.

d. **COCOMO-II :**

- i. COCOMO-II is the revised version of the original COCOMO and is developed at University of Southern California under the leadership of Dr. Barry Boehm.
- ii. The model is turned to the life cycle practices of the 21st century. It also provides a quantitative analytic framework, and set of tools and techniques for evaluating the effects of software technology improvements on software life cycle costs and schedules.
- iii. COCOMO-II provides three detailed cost estimation models. These can be used to estimate project costs at different phases of the software.
- iv. As the project progresses, these models can be applied at different stages of the same project.
  - a. **Application composition :** Here, the external features of the system that the users will experience are designed. Prototyping will typically be employed to do this with small applications that can be built using high-productivity application-building tools; development can stop at this point.
  - b. **Early design :** Here, the fundamental software structures are designed. With larger, more demanding systems, where, for example, there will be large volumes of transactions and performance is important, careful attention will need to be paid to the architecture to be adopted.
  - c. **Post architecture :** Here, the software structures undergo final construction, modification and tuning to create a system that will perform as required.

**Que 2.26.** Discuss the role of cost estimation in a software development project. Briefly explain COCOMO model for cost estimation for all category of projects.

**Answer**

In cost estimation, the number of estimation techniques have been developed and are having following attributes in common :

- i. Project scope must be established in advance.
- ii. Software metrics are used as a basis from which estimates are made.

3. The project is broken into smaller pieces which are estimated individually. To achieve reliable cost and schedule estimates, a number of options arise:

1. Delay estimation until late in project.
2. Use simple decomposition techniques to generate project cost and schedule estimates.
3. Develop empirical models for estimation.
4. Acquire one or more automated estimation tools.

**COCOMO model :** Refer Q. 2.25, Page 2-24K, Unit-1.

**Que 2.27.** Write short note on parametric productivity model.

#### Answer

1. In parametric productivity model, historical data and statistical modeling are used to assign a dollar value to certain project costs.
2. This approach determines the underlying unit cost for a particular component of a project and then sell that unit cost as appropriate.
3. It is much more accurate than analogous estimating but requires more initial data to accurately assess costs.
4. Parametric estimating is often used in construction.
5. For example, an experienced construction manager might understand that the typical new home will cost a certain number of Rupees per square foot (assuming a particular margin of error).
6. If this average cost, the margin of error, and the square footage of a new project are known, then parametric estimating will allow them to identify a budget that should accurately fall within this range.



## Activity Planning and Risk Management

### CONTENTS

<b>Part-1 :</b>	Objectives of Activity Planning, ..... 3-2K to 3-11K Project Schedules, Activities, Sequencing and Scheduling
<b>Part-2 :</b>	Network Planning Models, ..... 3-11K to 3-16K Formulating Network Models, Forward Pass and Backward Pass Techniques
<b>Part-3 :</b>	Critical Path (CPM) Method, ..... 3-16K to 3-20K Risk Identification, Assessment, Risk Planning, Risk Management Techniques, PERT Techniques Monte Carlo Simulation, Resource Allocation, Creation of Critical Paths, Cost Schedules

**PART-1**

*Objectives of Activity Planning, Project Schedules, Activities Sequencing and Scheduling.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 3.1.** Write short note on software project planning.

**Answer**

1. Project planning is an aspect of project management that ensures various project tasks are well coordinated and they meet the various project objectives including timely completion of the project.
2. The project plan reflects the current status of all project activities and is used to monitor and control the project.
3. Project planning is an ongoing effort throughout the project life cycle.
4. Project planning helps in :
  - a. Facilitating communication.
  - b. Monitoring/measuring the project progress.
  - c. Provides overall documentation of assumptions/planning decisions.
5. The project planning phases can be broadly classified as follows :
  - a. Development of the project plan.
  - b. Execution of the project plan.
  - c. Change control and corrective actions.

**Que 3.2.** Write down the outline of stepwise planning activities.

**Answer**

The stepwise planning is discussed as follows :

0. Select project
1. Identify project scope and objectives :
  - a. Identify objectives and measures of effectiveness in meeting them
  - b. Establish a project authority.
  - c. Identify stakeholders.
  - d. Modify objectives in the light of stakeholder analysis.

- e. Establish methods of communications with all parties.
2. **Identify project infrastructure :**
  - a. Establish relationship between project and strategic planning.
  - b. Identify installation standards and procedures.
  - c. Identify project team organization.
3. **Analyze project characteristics :**
  - a. Distinguish the project as either objective or product driven.
  - b. Analyze other project characteristics.
  - c. Identify high-level project risks.
  - d. Take into account user requirements concerning implementation.
  - e. Select general life cycle approach.
  - f. Review overall resource estimates.
4. **Identify project products and activities :**
  - a. Identify and describe project products (including quality criteria).
  - b. Document generic product flows.
  - c. Recognize product instances.
  - d. Produce ideal activity network.
  - e. Modify idea to take into account need for stages and checkpoints.
5. **Estimate effort for each activity :**
  - a. Carry out bottom-up estimates.
  - b. Revise plan to create controllable activities.
6. **Identify activity risks :**
  - a. Identify and quantify activity-based risks.
  - b. Plan risk reduction and contingency measures where appropriate.
  - c. Adjust plans and estimates to take account of risks.
7. **Allocate resources :**
  - a. Identify and allocate resources.
  - b. Revise plans and estimates to account for resource constraints.
8. **Review/publish plan :**
  - a. Review quality aspects of project plan.
  - b. Document plans and obtain agreements.
9. **Execute plan/lower levels of planning :**
  - a. This may require the reiteration of the planning process at a lower level.

**Que 3.3.** How do we identify the planning objectives ?

**Answer**

1. After all the stakeholders are identified, it is critical to identify what each stakeholder expects to gain from the project.
2. For instance, for an end user it might be that they are expecting a very user friendly and robust software with a number of features, while for a maintainer it is the quality of the documentation and the modifiability of the system that are important.
3. A manager would not want any overruns to the schedule, while the person who approves the budget might expect a low budget project.
4. By identifying each of the stakeholders "win" condition, the project's objectives are clear from the start.
5. In the negotiation with the customer, these objectives should be reinforced and documented.
6. Steps to identify the objectives are as follows :
  - a. Identify and allocate resources.
  - b. Understand how people will benefit from the project.
  - c. Prioritize objectives for the project.
  - d. Establish reasonable expectations on the parts of all the stakeholders.
  - e. Transform these objectives into project activities.
  - f. Identify and manage the risks.
  - g. Keep people involved. Keep senior management and the customer aware of the status of the project at all times.

**Que 3.4.** What are the different types of project planning involved in a project ?

**Answer**

Different types of project planning involved during project development :

- **Project scope definition and scope planning :**
  - a. In this step, we document the project work that would help us achieve the project goal.
  - b. We document the assumptions, constraints, user expectations, business requirements, technical requirements, project deliverables, project objectives and everything that defines the final product requirements.

**Quality planning :**

- a. Based on the inputs captured in the previous steps such as the project scope, requirements, deliverables, etc., various factors influencing the quality of the final product are determined.

- b. The processes required to deliver the product as promised and as per the standards are defined.

**Project activity definition and activity sequencing :**

- a. In this step, we define all the specific activities that must be performed to deliver the product by producing the various product deliverables.
- b. The project activity sequencing identifies the interdependence of all the activities defined.

**Time, effort and resource estimation :**

- a. The effort can be calculated using function points, lines of code, complexity of code, benchmarks, etc.
- b. This step clearly estimates and documents the time, effort and resource required for each activity.

**Risk factors identification :**

- a. It is important to identify and document the risk factors associated with the project based on the assumptions, constraints, user expectations, specific circumstances, etc.

**Schedule development :**

- a. The time schedule for the project can be arrived on the basis of the activities, interdependence and effort required for each of them.
- b. The schedule may influence the cost estimates, the cost benefit analysis and so on.
- c. Popular tools can be used for creating and reporting the schedules such as Gantt charts.

**Cost estimation and budgeting :**

- a. Based on the information collected in all the previous steps, it is possible to estimate the cost involved in executing and implementing the project.
- b. Based on the cost estimates, budget allocation is done for the project.

**Organizational and resource planning :**

- a. Based on the activities identified, schedule and budget allocation resource types and resources are identified.
- b. The goals of resource planning is to ensure that the project is run efficiently.
- c. Resource planning is an iterative process and necessary to optimize the use of resources throughout the project life cycle thus making the project execution more efficient.

**Risk management planning :**

- a. Risk management is a process of identifying, analyzing and responding to a risk.

- b. Based on the risk factors, identified risk resolution plan is created.
- 10. Project plan development and execution :**
- a. Project plan development uses the inputs gathered from all the other planning processes such as scope definition, activity identification, activity sequencing, quality management planning, etc.
  - b. A detailed work breakdown structure comprising of all the activities identified is used.
  - c. The project plan documents all the assumptions, activities, schedule, timelines and drives the project.
- 11. Performance reporting :**
- a. The progress of each of the tasks/activities described in the project plan is monitored.
  - b. The progress is compared with the schedule and timelines documented in the project plan.
  - c. Various techniques are used to measure and report the project performance such as EVM (Earned Value Management).
- 12. Planning change management :**
- a. Analysis of project performance can necessitate that certain aspects of the project be changed.
  - b. The Requests for Changes need to be analyzed carefully and its impact on the project should be studied.
  - c. Considering all these aspects the project plan may be modified to accommodate this request for change.

**Que 3.5.** What do you mean by project schedule ? Write down steps in building the project schedule.

**Answer**

**Project schedule :**

1. Scheduling is an inexact process in that it tries to predict the future.
2. While it is not possible to know with certainty how long a project will take, there are techniques that can increase the likelihood of being close.
3. If we are close in our planning and estimating, we can manage the project to achieve the schedule by accelerating some efforts or modifying approaches to meet required deadlines.
4. Building the project schedule is a complex activity.
5. Basically there are five key processes for developing a project schedule. They are as follows :

- 1. Define activities :**
  - i. The goal of the activity definition step is to identify all the tasks required to accomplish the product.
  - ii. This frequently results in identifying all the work products and deliverables that comprise the project.
  - iii. These deliverables are found as the components of a Work Breakdown structure (WBS).
  - iv. The project schedule further decomposes these deliverables into the actual activities required to complete the work.
- 2. Sequence activities :**
  - i. In this step, design the sequence of activities with dependencies required to complete the project.
  - ii. During this step, one will identify any dependencies of related tasks and document them in the project schedule.
  - iii. One will need to analyze each of the tasks to understand which task has a dependency on additional tasks.
  - iv. Dependencies relationships must include finish-to-start and start-to-finish dependencies.
- 3. Estimate activity resources :**
  - i. The next step is to identify the resources and their availability to our project.
  - ii. In this step, one will also assign resources to each of the tasks.
- 4. Estimate activity durations :**
  - i. With resources assigned, the next step is to estimate each task's duration.
  - ii. The activity's duration is the number of working periods required to complete the task.
  - iii. Selecting the correct duration type impacts the resource availability and the forecasted task end date.
- 5. Develop schedule :**
  - i. The last step is to analyze the project schedule and examine the sequences, durations, resources and inevitable scheduling constraints.
  - ii. The goal of this step is to validate the project schedule which correctly models the planned work.
  - iii. In this step one will not only validate the duration estimates are accurate, but validate the resource allocations are correct.

**Que 3.6.** What are the basic objectives of scheduling ?

**Answer**

The basic objectives of scheduling are as follows :

1. It is the basis for all planning and predicting and help management decide how to use its resources to achieve time and cost goals.
2. It provides visibility and enables management to control "one-of-a-kind" programs.
3. It helps management to evaluate alternatives by answering such questions as how time delays will influence project completion, when slack exists between elements, and what elements are crucial to meet the completion date.
4. It provides a basis for obtaining facts for decision-making.
5. It utilizes a so-called time network analysis as the basic method to determine manpower, material, and capital requirements, as well as provide a means for checking progress.
6. It provides the basic structure for reporting information.
7. It reveals interdependencies of activities.
8. It facilitates "what if" exercises.
9. It identifies the longest path or critical paths.
10. It aids in scheduling risk analysis.

**Que 3.7. | Discuss the various terms used in scheduling.****Answer**

Terminology used in scheduling are discussed as follows :

1. **Activity** : An element of work performed during the course of a project.
2. **Baseline** : The original plan plus or minus approved changes.
3. **Arrow Diagram Method (ADM)** :
  - a. A network diagramming technique in which activities are represented by arrows.
  - b. The tail of the arrow represents the start and the head of the arrow represents the end of the activity.
  - c. Activities are connected at points called nodes to illustrate the sequence in which activities are expected to be performed.
  - d. Also called Activity-On-Arrow (AOA).
4. **Backward pass** : The calculation of late finish and start dates for the uncompleted portions of all network activities determined by working backwards through the network logic from the project's end date.
5. **Critical activity** : An activity on a critical path.
6. **Critical path** :
  - a. The series of activities which determines the earliest completion of the project.
  - b. The critical path is usually defined as those activities with float less than or equal to a specified value (usually zero).
7. **Critical Path Method (CPM)** :
  - a. A network analysis technique used to predict project duration by analyzing which path has the least amount of scheduling flexibility.
  - b. Early dates are calculated using a forward pass; late dates are calculated using a backwards pass.
8. **Dummy activity** :
  - a. An activity of zero duration used to show a logical relationship in the arrow diagramming method.
  - b. Dummy activities are used when logical relationships cannot be completely or correctly described with regular activity arrows.
  - c. Dummies are shown graphically as a dashed line headed by an arrow.
9. **Duration (DU)** : The number of work periods required to complete an activity or other project element.
10. **Early finish date (EF)** : In the critical path method, the earliest possible date in which the uncompleted portions of an activity or project can complete and can change as the project progresses.
11. **Early start date (ES)** : In the critical path method, the earliest possible date in which the uncompleted portions of an activity or project can start, can change as the project progresses.
12. **Effort** : The number of labour units required to complete an activity or other project element. It should not be confused with duration.
13. **Event-on-node** : A network diagramming technique in which events are represented by boxes (or nodes) connected by arrows to show the sequence in which the events are to occur.
14. **Float** : The amount of time that an activity may be delayed from its early start without delaying the project finish date.
15. **Forward pass** : The calculation of the early start and early finish dates for the uncompleted portions of all network activities.
16. **Free Float (FF)** : The amount of time an activity can be delayed without delaying the early start of any immediately succeeding activities.
17. **Gantt chart** : A graphic display of schedule-related information using bars.
18. **Hammock** : An aggregate or summary activity.
19. **Hanger** : An unintended break in a network path. Hangers are usually caused by missing activities or missing logical relationships.

20. **Lag :** A modification of a logical relationship which directs a delay in the successor task.
21. **Late finish date (LF) :** In the critical path method, the latest possible date that an activity may be completed without delaying a specified milestone.
22. **Late start date (SF) :** In the critical path method, the latest possible date that an activity may begin without delaying a specified milestone.
23. **Lead :** A modification of a logical relationship which allows an acceleration of the successor task.
24. **Level of effort (LOE) :** Support type activity (for example, vendor or customer liaison) that does not readily lend itself to measurement of discrete accomplishment.
25. **Logical relationship :** A dependency between two project activities or between an activity and a milestone.
26. **Master schedule :** A summary level schedule which identifies the major activities and milestones.
27. **Milestone :** A significant event in the project, usually completion of a major deliverable.
28. **Milestone schedule :** A summary level schedule which identifies the major milestones.
29. **Path convergence :** In mathematical analysis, the tendency of parallel paths of approximately equal duration to delay the completion of the milestone where they meet.
30. **Precedence Diagram Method (PDM) :** A network diagramming technique in which activities are represented by nodes. Activities are linked by precedence relationships to show the sequence in which the activities are to be performed.
31. **Program Evaluation and Review Technique (PERT) :** An event oriented network analysis technique used to estimate project duration when there is a high degree of uncertainty with the individual activity duration estimates.
32. **Project network diagram :** Any schematic display of the logical relationships of project activities.
33. **Remaining Duration (RD) :** The time needed to complete an activity.
34. **Resource leveling :** Any form of network analysis in which start and finish dates are driven by resource management concerns.
35. **Resource-Limited schedule :** It is a project schedule whose start and finish dates reflect expected resource availability. The final project schedule should always be resource limited.
36. **Scheduled Finish date (SF) :** The point in time work was scheduled to finish on an activity. The scheduled finish date is normally within the range of dates delimited by the early finish date and the late finish date.

37. **Scheduled Start date (SS) :** The point in time work was scheduled to start on an activity. The scheduled start date is normally within the range of dates delimited by the early start and late start dates.
38. **Time-Scaled network diagram :** Any project network diagram drawn in such a way that the positioning and length of the activity represents its duration. Essentially, it is a bar chart that includes network logic.

**PART-2**

*Network Planning Models, formulating Network Model, Forward Pass and Backward Pass Techniques.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

Que 3.8. **What do you mean by activity networks ?**

**Answer**

1. The activity network is a graphical method for showing the order in which the tasks need to be completed and the dependencies between them.
2. The technique can be broken down into three stages :
  - a. **Planning :** It identifies tasks and estimate duration of times.
  - b. **Scheduling :** Establish time table of start and finish times.
  - c. **Analysis :** Establish the float and evaluate and revise as necessary.
3. They developed this technique for evaluating the performance of large development projects.
4. This is represented graphically, as shown in Fig. 3.8.1.

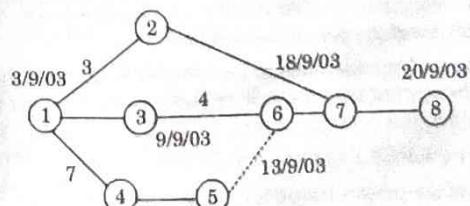


Fig. 3.8.1.

5. The diagram consists of a number of circles, representing events within the development life cycle, such as the start or completion of a task, and lines, which represent the task themselves.
6. Each task is additionally labeled by its time duration.
7. Thus the task between events 1 and 2 is planned to take 3 time units.
8. The primary benefit is the identification of the critical path.
9. In critical path, total time for activities on this path is greater than any other path through the network (delay in any task on the critical path leads to a delay in the project).
10. The degree of difficulty in developing a plan is usually a function of the number of activities or tasks, their sequence, their timing, and the complexity.
11. There are two types of activity networks diagram. They are :
  - a. Program Evaluation and Review Techniques (PERT)
  - b. Critical Path Method (CPM)

**Que 3.9.** Write a short note on PERT.

**Answer**

1. A Project (or program) Evaluation and Review Technique (PERT) chart is a project management tool used to schedule, organize, and coordinate tasks within a project.
2. PERT can be both a cost and a time management systems.
3. PERT is organized by events and activities or tasks.
4. PERT charts depict task, duration, and dependency information.
5. Each chart starts with an initiation node from which the first task, or tasks, originates.
6. If multiple tasks begin at the same time, they are all started from the node or branch, or fork out from the starting point.
7. Each task is represented by a line, which states its name or other identifier, its duration, the number of people assigned to it, and in some cases the initials of the personnel assigned.
8. The other end of the task line is terminated by another node, which identifies the start of another task, or the beginning of any slack time, that is, waiting time between tasks.

**Steps in drawing a PERT chart :**

1. Make a list of the project tasks.
2. Assign a task identification letter to each task.

3. Determine the time duration for each task.
4. Draw the PERT network, number each node, label each task with its task identification letter, connect each node from start to finish, and put each task's duration on the network.
5. Determine the need for any dummy tasks.
6. Determine the earliest completion time for each task node.
7. Determine the latest completion time for each task node and verify the PERT network for correctness.

**Que 3.10.** What are the benefits and limitation of PERT ?

**Answer**

**Benefits of PERT :**

1. The PERT network is continuously useful to project managers prior to and during a project.
2. The PERT network is straightforward in its concept and is supported by software.
3. The PERT network's graphical representation of the project's tasks help to show the task interrelationships.
4. The use of the PERT network is applicable in a wide variety of projects.
5. PERT is a scheduling tool that also shows graphically which tasks must be completed before other tasks begins.
6. By displaying the various task paths, PERT enables the calculation of a critical path.
7. PERT controls time and costs during the project and also facilitates finding the right balance between completing a project on time and completing it within the budget.
8. It exposes all possible parallelism in the activities and thus helps in allocating resources.
9. It allows scheduling and simulation of alternative schedules.

**Limitations of PERT :**

1. In order of the PERT network to be useful, projects tasks have to be clearly defined as well as their relationships to each other.
2. The PERT network does not deal very well with task overlap. PERT assumes the following tasks begin after their preceding tasks end.
3. The PERT network is only as good as the time estimates that entered by the project manager.
4. PERT does not help in deciding which activities are necessary or how long each will take.

**Ques 3.11.** Write a short note on CPM.

**Answer**

1. Critical Path Method (CPM) charts are similar to PERT charts and are sometimes known as PERT/CPM. CPM acts as the basis both for preparation of a schedule, and of resource planning.
2. During management of a project, it allows to monitor the achievements of project goals.
3. It also helps to see where remedial action needs to be taken to get a project back on course.
4. In a CPM chart, the critical path is indicated. Critical path is the path of longest duration as determined on a project network diagram.
5. The critical path determines the total duration of the project. If a task on the critical path is delayed, the final completion of the project will likely to be delayed.
6. The critical path is "critical" because tasks that follow a critical task cannot be started until all of the previous tasks on the critical path are completed.
7. Thus, if a task on the critical path is delayed, all tasks following the delayed critical task will be pushed out in time.
8. The critical tasks will have starting and finishing times, that is, fixed relative to the start of the project.
9. Tasks not on the critical path will usually have some flexibility relative to when they can start and finish.
10. This flexibility is called "float", or sometimes "slack". Float is the difference between the time available for performing a task and time required to complete a task.

**Benefits of CPM :**

1. It identifies the task that must be completed on time for the whole project to be completed on time.
2. It also identifies which tasks can be delayed for a while if resource needs to be reallocated to catch up on missed tasks.
3. CPM helps to minimize cost.

**Limitations of CPM :**

1. The relation of tasks to time is not as immediately obvious as with Gantt charts.
2. These are more difficult to understand.

**Ques 3.12.** Differentiate between PERT and CPM.

**Answer**

S. No.	<b>PERT</b>	<b>CPM</b>
1.	PERT uses event oriented network.	CPM uses activity oriented network.
2.	Estimate of time for activities is not so accurate and definite.	Durations of activity may be estimated with a fair degree of accuracy.
3.	It is used mostly in research and development projects, particularly projects of non-repetitive nature.	It is used extensively in construction projects.
4.	Probabilistic model concept is used.	Deterministic concept is used.
5.	PERT is basically a tool for planning.	CPM can control both time and cost when planning.
6.	In PERT, it is assumed that cost varies directly with time.	In CPM, the cost is not directly proportional to time. Thus, cost is the controlling factor.

**Que 3.13.** Write short note on forward pass techniques.

**Answer**

1. A forward pass in project management is a technique used to move through a project network diagram.
2. The forward pass helps you understand the project duration and calculate the early start and early finish values (meaning, the earliest day each project task can begin and wrap up).
3. Forward pass is a technique used for determining project duration and finding the critical path or Free Float of the project.
4. The term forward pass refers specifically to the essential and critical project management component in which the project team leader (along with the project team in consultation) attempts to determine the early start and early finish dates for all of the uncompleted segments of work for all network activities.
5. This technique is used for calculation of the early start dates and early finish dates for the project as well as the early start dates and the early finish dates for all activities that are contained within the project as a whole.

**Que 3.14.** What is backward pass techniques ?

**Answer**

In terms of project management, a backward pass also tends to have a negative implication, as it implies lateness.

A backward pass in the area of project management refers to the calculation of late finish dates and late start dates for the portions of schedule activities that have not been completed.

This is determined by starting at the project's scheduled end date and working backwards through the schedule network logic.

The end date may be set by the assigning party, or it may be determined through use of a forward pass.

This technique is used in the field of sports.

**PART-3**

*Critical Path (CPM) Method, Risk Identification, Assessment, Risk Planning, Risk Management Techniques, PERT Techniques Monte Carlo Simulation, Resource Allocation, Creation of Critical Paths, Cost Schedules.*

**Questions-Answers**

**Long Answer Type and Medium Answer Type Questions**

**Que 3.15.** Write short note on CPM.

**Answer**

Refer Q. 3.11, Page 3-14K, Unit-3.

**Que 3.16.** Write short note on risk management process.

**Answer**

Refer Q. 1.22, Page 1-16K, Unit-1.

**Que 3.17.** What are the factors which affects the risk identification procedure of any software project ?

**Answer**

Factors which affects the risk identification procedure of software project are :

**1. Application factors :**

- a. The nature of the application, whether it is a simple data processing application, a safety-critical system or a large distributed system with real-time elements is likely to be a critical factor.
- b. The expected size of the application is also important because the larger the system, the greater is the likelihood of errors and communication and management problems.

**2. Staff factors :**

- a. The experience and skills of the staff involved are clearly major factors. An experienced programmer is, one would hope, less likely to make errors than one with little experience.
- b. Such factors as the level of staff satisfaction and the staff turn-over rates are also important to the success of any project. Demotivated staff or key personnel leaving unexpectedly have caused many a project to fail.

**3. Project factors :**

- a. It is important that the project and its objectives are well defined and that they are absolutely clear to all members of the project team and all key stakeholders.
- b. Similarly, an agreed and formal quality plan must be in place and adhered to by all participants. The possibility that quality plan is inadequate or not adhered to will jeopardize the project.

**4. Project methods :**

- a. Using well-specified and structured methods for project management and system development will decrease the risk of delivering a system that is unsatisfactory or late.
- b. Using such methods for the first time, though, may cause problems and delays it is only with experience that the benefits accrue.

**5. Hardware/Software factors :**

- a. A project that requires new hardware for development is likely to pose a higher risk than one where the software can be developed on existing (and familiar) hardware.
- b. Where a system is developed on type of hardware or software platform to be used on another there might be additional (and high) risks at installation.

**6. Changeover factors :**

- a. Incremental or gradual changeover minimizes the risks involved but is not always practical.

- b. Parallel running can provide a safety net but might be impossible or too costly.

**7. Supplier factors :**

- a. The extent to which a project relies on external organizations that cannot be directly controlled often influences the project's success.

**8. Environment factors :** Changes in the environment can affect a project's success.

**9. Health and safety factors :** While not generally a major issue for software projects, the possible effects of project activities on the health and safety of the participants and the environment should be considered.

**Que 3.18.** Write short note on PERT.

**Answer**

Refer Q. 3.9, Page 3-12K, Unit-3.

**Que 3.19.** Explain in brief Monte Carlo simulation.

**Answer**

1. Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making.
2. The technique is used by professionals in such widely disparate fields as finance, project management, energy, manufacturing, engineering, research and development, insurance, oil and gas, transportation, and the environment.
3. Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities they will occur for any choice of action.
4. Monte Carlo simulation performs risk analysis by building models of possible results by substituting a range of values—a probability distribution—for any factor that has inherent uncertainty.
5. It then calculates results over and over, each time using a different set of random values from the probability functions.
6. Depending upon the number of uncertainties and the ranges specified for them, a Monte Carlo simulation could involve thousands or tens of thousands of recalculations before it is complete.
7. Monte Carlo simulation produces distributions of possible outcome values.

**Que 3.20.** What is resource allocation in project management?

**Answer**

1. Resource allocation is all about identifying and scheduling resources on various activities across your project(s) to achieve your project goals.
2. Resources in project management refer to anything you require to complete the project, including tools, equipment, facilities, or funding.
3. Resource allocation often falls to project managers, but some companies may also employ a resource or traffic manager for people planning and staff allocation.
4. Project managers are concerned with allocating and managing resources for the projects they are accountable for.
5. In contrast, resource managers take a more holistic view and look at resource allocation on a company level.
6. Resource allocation will help you identify and mitigate any risks, such as potential resource conflicts or gaps in availability, and manage your customers' or stakeholders' expectations.

**Que 3.21. | Write steps used to create critical paths.****Answer**

Following are the steps used to create critical path :

- 1. Step 1 : Specify Each Activity :**
  - a. Using the work breakdown structure, you need to identify each activity (or task) involved in the project.
  - b. This activity specification list should only include higher-level activities.
  - c. When detailed activities are used, the critical path analysis may become too complex to manage and maintain.
- 2. Step 2 : Establish Dependencies (Activity Sequence) :**
  - a. Some activities will depend on the completion of others.
  - b. Listing the immediate predecessors of each activity will help you identify the correct order.
- 3. Step 3 : Draw the Network Diagram :**
  - a. Once we have identified the activities and their dependencies, you can draw the critical path analysis chart (CPA), known as the network diagram.
  - b. The network diagram is a visual representation of the order of your activities based on dependencies.
- 4. Step 4 : Estimate Activity Completion Time :**
  - a. Using past experience or the knowledge of an experienced team member, we must now estimate the time required to complete each activity.

5. **Step 5 : Identify the Critical Path :**
6. **Step 6 : Update the Critical Path Diagram to Show Progress :**
  - a. As the project progresses, we will learn the actual activity completion times.
  - b. The network diagram can then be updated to include this information.

**Que 3.22.** Write short note on cost schedule.

**Answer**

1. A cost schedule is a table showing the total costs of production at different levels of output and from which marginal costs and average costs can be calculated and cost curves drawn.
2. While preparing such a schedule we can assume that the cost-determining factors such as method(s) of production, the prices of productive factors, etc., are all constant.
3. Assuming the cost-determining factors constant a cost schedule of a firm shows "the alternative cost of production at which various alternative outputs can be produced."
4. The cost and schedule estimation process helps in determining number of resources to complete all project activities.
5. It generally involves approximation and development of costing alternatives to plan, perform or work, deliver, or give project.



# 4

UNIT

## Project Management and Control

### CONTENTS

- |                 |   |                |
|-----------------|---|----------------|
| <b>Part-1 :</b> | Framework for Management .....<br>and Control, Collection of Data,<br>Visualizing Progress, Cost<br>Monitoring, Earned Value Analysis                   | 4-2K to 4-10K  |
| <b>Part-2 :</b> | Prioritizing Monitoring, .....<br>Project Tracking, Change<br>Control, Software Configuration<br>Management, Managing Contracts,<br>Contract Management | 4-10K to 4-20K |

**PART-1**

*Framework for Management and Control, Collection of Data, Visualizing Progress, Cost Monitoring, Earned Value Analysis.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions****Que 4.1. What is project management framework ?****Answer**

1. A project management framework consists of the processes, tasks, and tools used to take a project from start to finish.
2. It encompasses all the key components required for planning, managing, and governing projects.
3. The project management framework can be broken into three parts :
  - a. **Project life cycle :** This is the cycle a project goes through from beginning to end. It consists of five phases :
  - i. **Initiation :** In this phase, we define what the project actually is, objectives in a project charter and identify any potential risks.
  - ii. **Planning :** In this phase, we list all the project tasks in a detailed roadmap. Estimate how long each one will take, create deadlines, and add assignees.
  - iii. **Execution :** Put the plan into action. Teams commence work on project tasks and align their schedules to achieve key deliverables.
  - iv. **Monitoring and controlling :** Project managers oversee progress by tracking team performance, creating reports, and readjusting priorities if necessary.
  - v. **Closure :** The final phase incorporates the results achieved when all project tasks are completed. A project manager will analyze these results and plan the next steps.
- b. **Project control cycle :** The control cycle is the process of monitoring and controlling the project.
- c. **Tools and templates :** Project plans, project management reports, and risk logs are common tools and templates for managing projects.

**Que 4.2. Explain benefits of project management framework.****Answer**

Following are the benefits of project management frameworks :

1. **Consistency :**
  - a. With a project management framework, processes are consistent across the organization.
  - b. This allows for greater precision in planning projects and setting deadlines.
2. **Clarity :**
  - a. A framework clearly lays out all project tasks and the tools needed to complete them, meaning there is no confusion when teams get to the execution stage.
3. **Simplification :**
  - a. When large projects are broken down into smaller tasks, it is easier for project managers to delegate tasks and teams to tackle the workload.
4. **Optimization :**
  - a. A project management framework can help managers assess how much time and money is spent on each project.
  - b. This enables them to successfully allocate and optimize resources for future projects.
5. **Communication :**
  - a. By meeting regularly with teams as outlined in their chosen framework, project managers can effectively communicate with colleagues and boost information flow.

**Que 4.3. Write a short note on : Collection of Data.****Answer**

1. In any project long activities are break down into more controllable tasks of one or two weeks' duration.
2. However, it is necessary to gather information about partially completed activities.
3. And using this information, forecasts how much work is left to be completed.
4. However, it is difficult to make such forecasts accurately.
5. Also when there is a series of products, partial completion of activities is easier to estimate.
6. In some cases, intermediate products can be used as in-activity milestones.

7. For example, the first successful compilation of a program, might be considered a milestone even though it is not a final product.
8. For collecting data of partially completed activities following two methods are used :

**A. Partial completion reporting :**

1. Software companies use accounting systems along with weekly timesheets to charge staff time linked to individual jobs.
2. The staff time indicates the work carried out and the charges to the project.
3. However, it does not tell what has been produced or whether tasks are on schedule.
4. Hence it is necessary to adapt existing accounting data collection systems to meet the needs of project control.
5. For example, weekly timesheets are adapted by breaking jobs down to activity level.

**B. Red/Amber/Green (RAG) reporting :**

1. One of the drawbacks of partial completion reporting is asking for estimated completion dates.
2. This is overcome by asking the team members' estimates of the likelihood of meeting the planned target date.
3. One way to achieve this is using traffic-light method.
4. This consists of the following steps :
  - i. Identify the key (first level) elements for assessment in a piece of work;
  - ii. Break these key elements into constituent elements (second level);
  - iii. Assess each of the second-level elements on the scale green for 'on target', amber for 'not on target but recoverable', and red for 'not on target and recoverable only with difficulty';
  - iv. Review all the second-level assessments to arrive at first-level assessments;
  - v. Review first-and second-level assessments to produce an overall assessment.

**Que 4.4.** Give some methods of presenting a picture of the project and its future.

**OR**

Write a short note on : Visualizing Progress.

**Answer**

Following are various methods of presenting a picture of the project and its future :

**A. Gantt chart :**

1. Gantt chart is named after Henry Gantt (1861-1919).
2. It is simplest and oldest techniques for tracking the project progress.
3. It indicates scheduled activity dates and durations.
4. Reported progress is recorded on the chart (by shading activity bars).

**B. Slip chart :**

1. A slip chart is a version of the Gantt chart where a line is drawn from top to bottom.
2. To the left of the line are all the completed activities and to the right those activities (or parts of activities) that have not been completed.
3. It provides more striking visual indication of those activities that are not progressing to schedule.
4. The more the slip line bends, greater variation from the plan.
5. The more jagged the line, the more it means that there are some activities that are lagging to various degrees and some that are ahead of themselves.
6. A very jagged line means that there is scope for re-planning to move resources from those activities that are ahead to those that are behind.

**C. The timeline :**

1. The timeline method records the way that targets have changed throughout the project.
2. Planned time is plotted on the horizontal axis and actual time on the vertical axis.
3. The bendy lines going from top to bottom represent the scheduled completion date for each activity.

**Que 4.5. Write a short note on : Cost Monitoring.****Answer**

1. Cost Monitoring is critical for project success.
2. The information on cost monitoring is essential so that we can make management decisions.

3. Cost Monitoring is necessary to ensure that we meet financial targets.
4. Cost Monitoring can avoid budget and project overrun.
5. A project could be late because the staff originally committed have not been deployed.
6. In this case the project will be behind time but under budget.
7. A project could be on time but only because additional resources have been added and so it is over budget.
8. Hence we need to monitor both achievements and costs.

**Que 4.6. | What is cost management in project management ?**

**Answer**

1. Cost management is the process of estimating, allocating, and controlling project costs.
2. The cost management process allows a business to predict future expenses to reduce the chances of budget overrun.
3. Projected costs are calculated during the planning phase of a project and must be approved before work begins.
4. As the project plan is executed, expenses are documented and tracked, so things stay within the cost management plan.
5. Once the project is completed, predicted costs and actual costs are compared, providing benchmarks for future cost management plans and project budgets.

**Que 4.7. | What are the benefits and challenges of cost management ?**

**Answer**

**Benefits of cost management are :**

1. **Prevents overruns :** By allotting costs in the early planning stages, project managers ensure they don't overspend on specific areas.
2. **Avoids risk :** A good budget will have a risk allowance to ensure project success is not compromised if unforeseen costs arise.
3. **Aids future planning :** Cost reports can help with resource optimization. This can lead to more accurate budgets in the future.

**Challenges of cost management are :**

1. **Lack of resources :** If a project budget is too small, it can be difficult to secure the required labor, materials, etc., to complete the project successfully.

2. **Inaccurate estimation :** Poor forecasting can occur when a manager is inexperienced or doesn't fully understand the scope of the project. This can lead to cost overruns and affect overall profitability.
3. **Outdated technology :** Project managers need access to intuitive, up-to-date technology and tools to manage costs accurately.

**Que 4.8.** Explain different cost management tool used in project management.

**Answer**

Following are the cost management tools used in project management :

1. **Budgeting :**
  - a. For effective cost project management, we need an accurate budget.
  - b. This requires a budgeting tool to track costs using custom hourly rates and tailored financial fields.
2. **Time tracking software :**
  - a. This is particularly useful when trying to estimate resource cost.
  - b. When team members log hours using a task timer, project managers can use this data to determine how long a certain task takes, and allocate resources accordingly.
3. **Reporting and analytics tools :**
  - a. For real-time insights into their cost management process, project managers should generate weekly reports with detailed charts and graphs.
  - b. Analytics dashboards can also be created for a project portfolio overview.

**Que 4.9.** What do you understand by earned value analysis and management ? Explain with example. Why many individuals and firms have failed to adapt the methods under earned value analysis and management ? Discuss.

**Answer**

**Earned value analysis :**

1. Earned Value Analysis (EVA) used to determine the performance of large military procurement contracts.
2. Its techniques can still be applied to the smaller projects currently in use today.
3. EVA uses at three basic parameters :

- a. Planned Value
  - b. Earned Value
  - c. Actual Cost
4. By comparing these parameters, an objective assessment of cost and schedule performance can be gained.

**Earned value management :**

- 1. Earned Value Management (EVM) has proven itself to be one of the most effective performance measurement and feedback tools for managing projects.
- 2. It enables managers to close the loop in the plan-do-check-act management cycle.
- 3. If the application of EVM to a project reveals that the project is behind schedule or over budget, the project manager can use the EVM methodology to help identify :
  - a. Problem occurring
  - b. Critical problem
  - c. Project tracking
- 4. EVM provides organizations with the methodology needed to integrate the management of project scope, schedule, and cost.
- 5. EVM strategically augments good project management to facilitate the planning and control of cost and schedule performance.
- 6. The key practices of EVM include :
  - a. Establish a performance measurement baseline (PMB)
    - i. Decompose work scope to a manageable level.
    - ii. Assign unambiguous management responsibility.
    - iii. Develop a time-phased budget for each work task.
    - iv. Select EV measurement techniques for all tasks.
    - v. Maintain integrity of PMB throughout the project.
  - b. Measure and analyze performance against the baseline
    - i. Record resource usage during project execution.
    - ii. Objectively measure the physical work progress.
    - iii. Credit EV according to EV techniques.
    - iv. Analyze and forecast cost/schedule performance.
    - v. Report performance problems and/or take action.

**Many individuals and firms have failed to adapt the methods under earned value analysis and management because :**

- a. The first stage in setting up an earned value analysis is to create the baseline budget.
- b. The baseline budget is based on the project plan and shows the forecast growth in earned value through time.
- c. Earned value may be measured in monetary values but, in case of staff-intensive projects such as software development, it is common to measure earned value in person-hours or work days.

**Que 4.10. | What are the essentials of EVM ?**

**Answer**

The essentials of EVM are as follows :

1. A clear set of well defined, accomplishable and measurable deliverables.
2. A clear set of standards to judge whether a deliverable has been accomplished.
3. An ability to know when and how work can be divided among multiple persons.
4. A method of determining parallel and serial deliverable accomplishment efforts.
5. An ability to know all the different staff and skills necessary for deliverable accomplishment.
6. A clear set of well defined, accomplishable, and measurable tasks that result in accomplished deliverables.
7. A clear set of staff hour, unit-effort-based, allocations to accomplish deliverables via tasks.
8. A strategy to assess staff and quantify the velocity at which they work, in order to accomplish deliverables.
9. An enumeration of work environment factors that affect the rate of deliverable accomplishment.
10. A strategy to quantify and assign work environment factors to individual deliverable accomplishments.

**Que 4.11. | Show the relationship among earned value key parameters, earned value performance measures and earned value forecasting indicators.**

**Answer**

Fig. 4.10.1 shows the relationship among earned value key parameters, earned value per measures and earned value forecasting indicators.

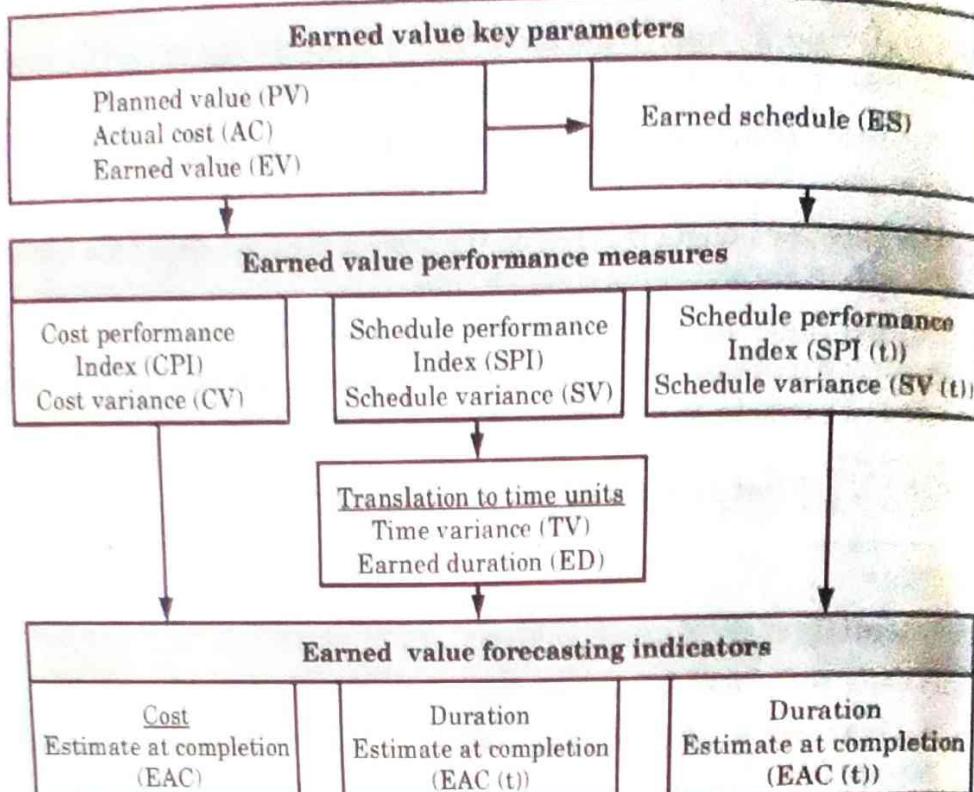


Fig. 4.11.1.

**PART-2**

*Prioritizing Monitoring, Project Tracking, Change Control, Software Configuration Management, Managing Contract, Contract Management.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 4.12.** Explain prioritizing monitoring in SPM.

**Answer**

1. Prioritization is the process by which a set of items are ranked in order of importance.
2. In product management, initiatives that live in the backlog must be prioritized as a means of deciding what should be developed next.
3. The process of prioritizing projects is an activity for defining what projects within a portfolio to perform in what sequence.

4. It is an attempt to make the project portfolio more effective through identifying the most effective way of implementing the projects.
5. Project prioritization is the process of determining which potential and existing projects are the most urgent and important.
6. This process involves evaluating the criteria that are most relevant to your business and applying them to all of our projects.
7. Project prioritization ensures that we correctly allocate company resources based on our unique needs.
8. By prioritizing tasks, a company can minimize the time and money it spends on less urgent and important projects.

**Que 4.13. | What are the different priorities that helps in deciding levels of monitoring ?**

**Answer**

Following are the different priorities that helps in deciding levels of monitoring :

**1. Critical path activities :**

- i. Any delay in an activity on the critical path will cause a delay in the completion date for the project.
- ii. Critical path activities are therefore likely to have a very high priority for close monitoring.

**2. Activities with no free float :**

- i. A delay in any activity with no free float will delay at least some subsequent activities.
- ii. Even though, if the delay is less than the total float, it might not delay the project completion date.
- iii. These subsequent delays can have serious effects on resource schedule.

**3. Activities with less than a specified float :**

- i. If any activity has very little float it might use up this float before the problem is brought to the project manager's attention.
- ii. It is common practice to monitor closely those activities with less than one week free float.

**4. High-risk activities :**

- i. A set of high-risk activities should have been identified as part of the initial risk profiling exercise.
- ii. For example in PERT three-estimate approach we will designate as high risk those activities that have a high estimated duration variance.

- iii. These activities will be given close attention because they are most likely to overrun.

### 5. Activities using critical resources :

- i. Activities can be critical because they are very expensive.
- ii. An activity that demands a critical resource requires a high level of monitoring.

**Que 4.14.** Write short note on project tracking.

**Answer**

1. Project tracking is a project management method used to track the progress of tasks in a project.
2. By tracking our project, we can compare actual to planned progress, and identify issues that may prevent the project from staying on schedule and within budget.
3. Project time tracking helps the project team and stakeholders see how much time is getting spent by team members at every stage of the project management process.
4. A time tracking report helps the team to see how much time overall is spent on specific tasks and how much individual team members spend on tasks.
5. A project manager is a person who has the overall responsibility for the successful initiation, planning, design, execution, monitoring, controlling and closure of a project.
6. Project tracking keeps all team members and stakeholders in touch with deadlines and goals, enabling the project lead to manage with confidence.

**Que 4.15.** Write a short note on : Change Control.

**Answer**

1. In any software project the nature of the deliverables is constantly changing.
2. The user requirements document undergoes cycles of development and review.
3. So there may be many different versions of the document.
4. Any change control process at this point would be very informal and flexible.
5. At some point an assumed final version will be created.
6. This is known as baselined product.
7. Baseline products are the foundation for the development of further products.

8. Any changes to the baselined document have direct effects on other parts of the project.

**Que 4.16.** What do you understand by Software Configuration Management (SCM) ? What are its goals ?

**Answer**

1. Software Configuration Management (SCM) is one of the foundations of software engineering. It is used to track and manage the emerging product and its versions.
2. This is to assure quality of the product during development, and operational maintenance of the product.  
SCM ensures that all people involved in the software process know what is being designed, developed, built, tested, and delivered.
- Through SCM, the design requirements can be traced to the final software product.

Thus, the Software Configuration Management (SCM) can be defined as a process of defining and implementing a standard configuration, which results into the primary benefits such as easier setup and maintenance, less down-time, better integration with enterprise management, and more efficient and reliable backups and also maximize productivity by minimizing mistakes.

**Goals of software configuration management :**

1. Software configuration management activities are planned.
2. Selected software work products are identified, controlled, and available.
3. Changes to identified software work products are controlled.
4. Affected groups and individuals are informed of the status and content software baselines.

**Que 4.17.** What are the objectives of software configuration standards ?

**Answer**

**Objectives of software configuration standards :**

- i. **Remote system administration :**
  - a. The configuration standard should include necessary software and/or privileges for remote system administration tools.
  - b. A remote administration client, that is, correctly installed and configured on the client side is the cornerstone of the remotely administered network.

- c. These remote tools can be used to check the version of virus protection, check machine configuration, or offer remote help-desk functionality.

**ii. Reduced user down-time :**

- a. A great advantage of using a standard configuration is that system becomes completely interchangeable resulting in reduced user down-time.
- b. If a given system experiences an unrecoverable error, an identical new system can be dropped into place.
- c. User data can be transferred if the non-functional machine is still accessible, or the most recent copy can be pulled off the backup tape with the ultimate goal being that the user experiences little change in the system interface.

**iii. Reliable data backups :**

- a. Using a standard directory for user data allows backup systems to selectively backup a small portion of a machine, greatly reducing the network traffic and tape usage for backup systems.
- b. Also, should a catastrophic failure occur, the data directory could be restored to a new machine with little time and effort.
- c. A divided directory structure, between system and user data, is one of the main goals of the configuration standard.

**iv. Easy workstation setup :**

- a. Any sort of standardized configuration streamlines the process of setting up the system and insures that vital components are available.
- b. If multiple machines are being setup according to a standard setup, most of the setup and configuration can be automated.

**v. Multi-user support :**

- a. Although, it is common for users to share a workstation, the system configuration is designed to allow multiple users to use the same workstation without interfering each other's work.
- b. Some software packages do not support completely independent settings for all users; however, users can have independent data areas.
- c. The directory structure implemented does not impose limits on the number of independent users a system, can have.

**vi. Remote software installation :**

- a. Most modern software packages are installed in factory pre-defined directories. While software installed in the manner will function correctly for a single user, it will lead to non-uniform configuration among a collection of machines.

- b. A good configuration standard will have software installed in specified directory areas to logically divide software on the disk.
- c. This will lead to easier identification of installed components and the possibility of automating installation procedures through the use of universal scripts.
- d. With software installed into specific directories, maintenance and upgraded running software becomes less complex.

**Que 4.18. | Illustrate the various SCM activities.****Answer**

Following are the four major SCM activities :

**1. Configuration identification :**

- a. SCM process manages all the software entities and their related representations in documentation.
- b. Basically, SCM should manage all software related components that are used during development, testing, and production.
- c. The identification and structuring of the software configuration management plan is done when the software process is being defined.
- d. Software configuration items (SCIs) added to the SCM are things such as tools, design documents, requirements documents etc.
- e. The SCI that are identified, determine the baseline(s), that is, associated with the project.
- f. The number and types of baselines will depend upon the project. Baselines are the core of SCM; they provide a stable platform for work to continue from.
- g. Only authorized changes can be made to the baseline, and all changes are recorded as deltas until such time as a new baseline is generated.

**2. Change control :**

- a. Change control involves procedures and tools to bring in order to change process.
- b. Larger projects have a formal change control board (CCB), whose responsibility is to review and approve and disapprove changes.
- c. It is the CCB responsibility to provide the mechanism to maintain orderly change process.
- d. The CCB includes the following individuals :
  - i. Executive sponsor
  - ii. Customer representative

- iii. Marketing representative
- iv. Program manager
- v. Project manager
- vi. Quality assurance manager
- vii. Documentation leader

**3. Software configuration status reporting :**

- a. Software configuration status reporting (or accounting) is a record keeping activity of software configuration management.
- b. From the time the first SCI's were identified, all changes and the current status of changes and documents are recorded in a status accounting database.
- c. The record in the database provides management with reports as to the current state of the project.
- d. The configuration status accounting database holds the records showing the products history, how the product has evolved, and where the system is at anytime in the relation to the current baseline.
- e. Administrator uses status accounting to track and report on all SCI's formally identified and controlled. The status accounting database also maintains records to supports SCM auditing.

**4. Audit and reviews :**

- a. Audits and reviews are used to ensure that changes have been properly implemented. The formal review looks at the technical correctness of any SCI that has been modified.
- b. An SCI is looked as to determine any omissions, potential side effects, and its consistency with other SCIs.
- c. Formal reviews are conducted for all but the most trivial changes.
- d. Auditing gives us a picture of how close the current software system mirrors the software systems pictured in the baseline and the requirements documents.
- e. Auditing provides the mechanism for establishing a new baseline. The final stages of an audit are used to sanction the new baseline.
- f. Auditing increases the software visibility and established traceability. It helps to avoid costly re-design and refits.

**Que 4.19. Explain software configuration items, and baselines.**

**Answer**

**Configuration item :**

1. A configuration item (CI) is any component of an information technology infrastructure, that is, under the control of configuration management.

2. Configuration items (CIs) can be individually managed and versioned, and they are usually treated as self-contained units for the purposes of identification and change control.
3. All configuration items (CIs) are uniquely identified by names, version numbers, and other attributes. The lowest level CI is usually the smallest unit that will be changed independently of other components.
4. CIs vary in complexity, size, and type. They can range from an entire service which may consist of hardware, software and documentation to a single program module or a minor hardware component.

**Configuration baselines :**

1. Configuration Management (CM) plans establish and document the requirements, standards, practices, and procedures for configuration management.
2. This includes defining baselines and establishing the labeling scheme for configuration items.
3. A baseline is a group of configuration items (products, deliverables) developed during a specific phase of the development process that has been formally accepted.
4. Once the baseline is established, changes to the items can only be done through a formal change process.
5. In other words we can say a software baselines library is established containing the software baselines as they developed.
6. Changes to baselines and the release of software products built from the software baseline library are systematically controlled via the change control and configuration auditing functions of software configuration management.

**Que 4.20. What is contract management in project ?****Answer**

1. Contract management is the overseeing of a project's contracts from their initial pre-award phase through to completion.
2. Contract management ensures that the project's budget and resources are in alignment with its overall objectives.
3. Tracking contracts as they progress and identifying and managing any issues as they come up is an important project management process.
4. Contract management, as a part of the project management, deals with the vendors, sellers, and/or suppliers and the managing of procurements according to the terms and conditions set within contracts.
5. Contract management systems can ease the workload needed to get to contract creation and its following stages of contract management.

6. Contract software often has a contractor database built-in, can generate Request for Proposals (RFPs), and perform bid analysis.
7. Once a contractor is selected, contract systems help project organizations to award the contract, send letters of regret to those not chosen, and manage contractor changes and invoicing all within the software.

**Que 4.21.** Explain different phases of contract management.

### Answer

Following are the phases of contract management :

**1. Phase 1 : Contract Creation :**

- a. It's important that contract management systems are able to incorporate standardized procedures with details specific to organizational objectives.
- b. This contract management stage involves identifying the contract type and who will be responsible for each task.

**2. Phase 2 : Contract Negotiation :**

- a. All project contracts ought to be written in a manner that reflects the organizational objectives and values.
- b. Negotiation helps to establish trust between the contract's two parties.
- c. After the initial contract is drawn up, negotiation occurs in which line items are discussed, changed, updated, or completely removed.

**3. Phase 3 : Contract Approval :**

- a. Contract approval often involves multiple sign-offs from various managers and departments, as well as contractors and vendors.
- b. All may have to give approval on the contract's specifications before the final deal is made.

**4. Phase 4 : Contract Finalization :**

- a. The process of contract signing between the involved parties is the final step to getting the project started.
- b. This is why the ability to get signatures from all involved parties quickly, regardless of distance or location, is crucial to avoid delays.

**5. Phase 5 : Contract Change Management :**

- a. Project changes are guaranteed to occur throughout the project lifecycle once the work begins.
- b. Project changes need to be managed carefully and all changes need to be communicated to the appropriate parties.

**Que 4.22.** Write in brief about issues faced during contract management.

**Answer**

Issues faced during contract management are :

1. **Contract Execution** : Poor contract management often leads to lost or missing files, and final contract approvals and signatures take significantly longer to obtain.
2. **Contract Tracking** : Monitoring and tracking signed contracts that are then passed along to other team members or departments who may not be familiar with them is crucial to avoiding delays. Project delays lead to project overspending.
3. **Contract Revisions** : Managing contract changes before and after contract approval is important to project success. Having a tool in place to help track changes across time zones, regions, and teams aids in ensuring version control and timely proven delivery. All of this helps to minimize risk, delays, errors, etc.
4. **Contract Compliance** : Contracts help ensure compliance within the parameters agreed upon. Effective contract management establishes compliance and regulation across the project in ways that help organizations avoid legal issues and consequences.

**Que 4.23. | What are the benefits of contract management ?****Answer**

Following are the benefits of contract management :

1. Streamlines your RFP process.
2. Vendor and bid management.
3. Improves bid analyses.
4. Transforms contract administration.
5. Contract change management.
6. Procurement and resource planning.
7. Enhances communication and collaboration.
8. Audit trail and documentation records.
9. Compliance.
10. Delivering projects on-time and within budget.

**Que 4.24. | Why contract management is necessary ?****Answer**

1. Project contracts establish and provide parameters for key project business strategies, processes, and relationships.

2. Effective contract management can help enterprises and project organizations to better compete globally, especially those with **distanced teams**, and/or those with varying time zones and cultures.
3. It also provides project organizations with monitoring and **tracking**.
4. Contract management helps project organizations to take into account how project productivity, performance, labor, and inventory **affect their growth and profitability** throughout the project.
5. It keeps tabs on communication, tracking, change control and other tasks.





## Staffing in Software Projects

### CONTENTS

<b>Part-1 :</b> Managing People,.....	<b>5-2K to 5-7K</b>
Organizational Behaviour, Best Methods of Staff Selection, Motivation	
<b>Part-2 :</b> The Oldham Hackman Job .....	<b>5-7K to 5-11K</b>
Characteristics Model, Stress, Health and Safety, Ethical and Professional Concerns	
<b>Part-3 :</b> Working in Team, Decision .....	<b>5-11K to 5-20K</b>
Making, Organizational Structure, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership	

**PART-1**

*Managing People, Organizational Behaviour, Best Methods of Staff Selection, Motivation.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 5.1.** How to manage people by understanding their behaviour?

**Answer**

**Understanding behavior :**

1. Handling of people with practical experience becomes a vital role in the aspect of project management.
2. The managers must be able to decide on whether it is better to have experienced staff or get an expert advice.
3. Organizational behaviour has defined numerous theories to explain people's behavior.
4. The theories are structures based on "If A is the situation then B is likely to be the solution".
5. Other than the structures, there a wide range of influences on a situation which are invisible to the users which makes it difficult to decide on the solution.

**Que 5.2.** Write a short note on : Organizational behavior.

**Answer**

**A Work objectives :**

1. Fredrick Taylor analyzed the productive way of doing things and trained the workers with these objectives :
  - i. To select the best people for the job
  - ii. To instruct them in the best methods
  - iii. To give them incentives based on their performance
2. These work objectives defined by Taylor emphasis exclusively on the financial basis of the staff motivation and performance-related pay.

3. This encouragement to the staff will help the project group to work together in achieving their goals which ultimately increases the productivity.
4. People may be motivated by money, but they are motivated by other factors as well.

### Theory X and Theory Y :

1. Some managers' work for money being instrumental or called as cash-oriented persons can be categorized based on their individual attitudes.
2. Donald McGregor labeled two different attitudes as Theory X and Theory Y.
3. Theory X includes :
  - i. On an average, not every human likes to work.
  - ii. Somebody must have the control and direct the person to work.
  - iii. Generally, people do not like hold responsibilities.
4. Theory Y includes :
  - i. People must like to work not forced to do it.
  - ii. External control is not the way to reach organizational goals.
  - iii. There must a commitment towards the work allocated to individuals.
  - iv. An average human can learn to accept and seek responsibility.
  - v. Creative qualities must be widely distributed.
5. Individual's behavior towards the organization can be observed when their boss is not available.
6. Theory X environment makes everybody to relax which can be seen visibly whereas Theory Y is more a goal oriented approach of the people involved in the development.
7. A reward does not need to be a financial reward but it could be something like a sense of achievement.
8. This theory explains the expectations which have a greater influence towards the organizational behavior.

**Que 5.3. | How to select the right person for the right job ?**

### Answer

1. Taylor formulated this factor of selecting the right person for the right job.
2. The other factors which includes the use of software tools, methodologies, programming productivity and so on.

3. It is always better to have the best people employed in the **right place of work** for effective productivity.
4. Say for example, a study on comparing experienced **programmer** in debugging a code with a less experienced person was **futile when the results were drawn**.
5. According to Gerald Weinberg, "Most programmers prefer to **work alone** where they are not disturbed by other people".

**Que 5.4.** Write a short note on : Recruitment process.

**Answer**

1. There is a lot of stress for every project manager **about choosing the right people** to make up their team.
2. Recruitment is an organizational responsibility process of **selecting the person** from their organization.
3. Meredith Belbin categorizes people in recruiting process into **two different types** :
  - i. **Eligible candidates** : Are those persons who **have the right information** needed by the organization in paper, i.e., the **curriculum vitae** contains the right number or years and **right paper qualifications**.
  - ii. **Suitable candidates** : Can actually do the job **well but are not officially eligible**. Ideal candidates once given a post **are likely to be more loyal** towards the welfare of the organization.
4. Actual skills have to be taken into account while **selecting a person** rather than mere eligibility.
5. The recruitment policy must avoid discrimination of **race, gender, age or irrelevant disabilities**.
6. A recruitment process must include :
  - i. **Creation of job specification** : Type of task that has to be **carried out** must be documented and agreed.
  - ii. **Creation of job profile** : Constructs a profile of the person **needed to carry out the job** with qualities, qualifications, education and experience.
  - iii. **Obtaining applicants** : Placing an advertisement **within the organization** or the local press to get a maximum number of **potential applicants**.
  - iv. **Examine Curriculum Vitae** : All the received CV's are **compared** with the job holder profile and if satisfied are called for interview.
  - v. **Interviews** : These include the aptitude tests, technical tests, personality tests and examination of previous work. Group

discussions are also used for evaluating and examining the statements provided in the CV.

- vi. **References :** Need to be verified and a medical examination test can also be done if needed.

**Que 5.5.** Explain the various motivation theories formulated for motivating people to work.

**Answer**

Following are various theories formulated by different persons for motivating the people to work. They are :

**A. Taylorist Model :**

1. In this model, Taylor emphasis on the piece-rates and day-rates.
2. Piece-rates are those where the workers are paid a fixed sum for each single item they produce whereas day-rates refer to the daily pay that is given to the workers on a timely basis.
3. The tendency towards dispersed or virtual projects where the staffs either work in organization or work at home has a difference in the payment based on time worked.
4. The amount paid to the workers will not directly relate to maximize the output in order to maximize their income.
5. The amount of output will normally depend on the working group and not based on an individual.
6. A reward based on piece-rates is directly proportional to the work produced. But a support team cannot be adjudged by a single person, instead it is group activity and the reward must be given to the group as a whole.
7. In Taylorist model, the reward system makes excessive distinctions between co-workers that result in damaging morale and productivity.
8. This can be balanced by giving bonuses to project team members after completion of a successful project.

**B. Maslow's Hierarchy of Needs :**

The basic human needs placed by Maslow in an ascending order of importance are :

1. **Physiological Needs :** These are the basic needs for sustaining human life itself, such as food, water, warmth, shelter, and sleep. Maslow felt that until these needs are satisfied to the degree necessary to maintain life, other needs will not motivate people.
2. **Security or Safety Needs :** These are the needs to be free of physical danger and of the fear of losing a job property, food, or shelter.

3. **Affiliation or Social Needs :** Since people are social beings; they need to belong, to be accepted by others. It includes friendship, the need to love and be loved, socializing, etc.
4. **Esteem Needs :** Once people begin to satisfy their need to belong; they tend to want to be held in esteem both by themselves and by others. This kind of need produces such satisfactions as respect, power, prestige, status, and self-confidence.
5. **Self-actualization Needs :** This is the highest need in the hierarchy. It is the desire to become what one is capable of becoming to fully realize one's potential and to accomplish what one is capable of achieving.

#### C. Herzberg's Two-Factor Theory :

1. People tend to be dissatisfied about their job due to certain factors. They are :
  - i. Hygiene or maintenance factors
  - ii. Motivators
2. A hygiene factor makes the person dissatisfied if they are not rightly used. For example, the working condition of the worker.
3. Motivators can make the person feel that the job is worth doing it, like a sense of achievement or the challenge of the work.
4. Higher-level of maintenance factors can be provided by large organizations whereas better motivation can be provided to workers who work in smaller organizations.

#### D. Expectancy Theory of Motivation :

1. Vroom identified three influencing factors on motivation. They are :
  - i. Expectancy
  - ii. Instrumentality
  - iii. Perceived value
2. Expectancy is a belief that working harder will lead to better performance.
3. Instrumentality is the belief that better performance will be rewarded.
4. Perceived value denotes the resulting reward.
5. When all these factors are high, then the motivation level will also be high. At the same time, a zero level for any one of the factor can remove motivation completely.
6. For example, when the developer is supposed to get a software package supplied by a third party to work and it contains a bug, the worker gives up since how much hard work the worker puts in it will not lead to success denotes zero expectancy.

7. On the other side, if the user is not using the package supplied by the developer, instead the user works on an alternative tool; it makes the developer feel that it is waste of time and leads to zero instrumentality.
8. Suppose if the user is using the package but keeps on complaining about the package and makes the developer responsibility for all short-comings, then at some point of time the developer will not like to get involved for implementing a newer package which leads to low perceive value of reward.

## PART-2

*The Oldham Hackman Job Characteristics Model, Stress, Health and Safety, Ethical and Professional Concerns.*

### Questions-Answers

### Long Answer Type and Medium Answer Type Questions

**Que 5.6.** Write short note on Oldham Hackman job characteristics.

#### Answer

Hackman and Oldham's job characteristics theory proposes that high motivation is related to experiencing three psychological states and five core job characteristics.

##### A. Three psychological states :

###### 1. Meaningfulness of work :

- i. That labour has meaning to you, something that you can relate to, and does not occur just as a set of movements to be repeated.
- ii. This is fundamental to intrinsic motivation, i.e., that work is motivating in and of itself.

###### 2. Responsibility :

- i. That you have been given the opportunity to be a success or failure at your job because sufficient freedom of action has given you.
- ii. This would include the ability to make changes and incorporate the learning you gain whilst doing the job.

**3. Knowledge of outcomes :**

- i. It provides the person knowledge on how successful their work has been, which in turn enables them to learn from mistakes.
- ii. It connects them emotionally to the customer of their outputs, thus giving further purpose to the work.

**B. Five core job characteristics :**

1. **Skill variety** : Using an appropriate variety of your skills and talents: too many might be overwhelming, too few, boring.
2. **Task Identity** : Being able to identify with the work at hand as more whole and complete, and hence enabling more pride to be taken in the outcome of that work.
3. **Task Significance** : Being able to identify the task as contributing to something wider, to society or a group over and beyond the self.
4. **Autonomy** : The discretion you have about the way that you do the job.
5. **Feedback** : The information you get back about the results of your work.

**Que 5.7. What are the causes of stress in project management ?****Answer**

Following are the causes of stress in project management :

1. Unrealistic timeline.
2. Working in a matrix system which PM does not have the full control of the resources.
3. Lack of resources, human and/or equipment.
4. Proliferation of virtual teams and cross cultural influences.
5. Inter-group conflict in organization.
6. Project environment.

**Que 5.8. Explain different stress management techniques.****Answer**

Following are the different stress management techniques :

**1. Prioritize :**

- a. Put up a priority matrix and assign every task based on its urgency and importance.
- b. Focus on the tasks that are urgent and important.
- c. Don't overwhelm yourself by worrying about your entire workload.

**2. Applying NLP (Neuro-Linguistic Programming) to Stress Reduction :**

- a. NLP provides a number of excellent tools and concepts to empower individuals to cope with or change non-resourceful or negative stress to resourceful or positive resources.
- b. With NLP you can change overwhelming, immobilizing feelings into powerful motivating forces.

**3. Exercise :**

- a. Take some time off from your busy schedule and plan for some physical activities, whether it's jogging, cycling, hiking or other activities to work off stress.

**4. Meditation :**

- a. Meditation and breathing exercises have been proven to be very effective in controlling stress.
- b. Practice clearing your mind of disturbing thoughts.

**5. Develop potent conflict resolution skills :**

- a. We add stress to our work lives by either under reacting to the stressful situation (avoiding or denying it) or over reacting to the stressful situation (coming on too strong).

**Que 5.9.** How health and safety is a part of an organization.

**Answer**

A safety and health management system means the part of the organisation's management system which covers :

1. The health and safety work organisation and policy in a company
2. The planning process for accident and ill health prevention
3. The line management responsibilities and
4. The practices, procedures and resources for developing and implementing, reviewing and maintaining the occupational safety and health policy.
5. The system should cover the entire gambit of an employer's occupational health and safety organisation.

**Que 5.10.** What are the elements of a safety and health management system ?

**Answer**

Following are the elements of a successful safety and health management system :

**1. Policy and commitment :**

- a. The workplace should prepare an occupational safety and health policy programme as part of the preparation of the Safety Statement required by Section 20 of the Safety, Health and Welfare at Work Act, 2005.
- b. Effective safety and health policies should set a clear direction for the organisation to follow.

**2. Planning :**

- a. The workplace should formulate a plan to fulfill its safety and health policy as set out in the Safety Statement.
- b. An effective management structure and arrangements should be put in place for delivering the policy.
- c. Safety and health objectives and targets should be set for all managers and employees.

**3. Implementation and operation :**

- a. For effective implementation, organisations should develop the capabilities and support mechanisms necessary to achieve the safety and health policy, objectives and targets.
- b. All staff should be motivated and empowered to work safely and to protect their long-term health, not simply to avoid accidents.

**4. Measuring performance :**

- a. The organisation should measure, monitor and evaluate safety and health performance.
- b. Performance can be measured against agreed standards to reveal when and where improvement is needed.
- c. Active self-monitoring reveals how effectively the safety and health management system is functioning.

**5. Auditing and reviewing performance :**

- a. The organisation should review and improve its safety and health management system continuously, so that its overall safety and health performance improves constantly.
- b. The organisation can learn from relevant experience and apply the lessons.

**Que 5.11. Why ethics is important for project management ?****Answer**

1. Project management ethics is an essential ingredient while managing projects.
2. According to the PMI (Project Management Institute), Ethics is about making the best possible decisions concerning people, resources and the environment.

3. Ethical choices diminish risk, advance positive results, increase trust, determine long term success and build reputations.
4. Leadership is absolutely dependent on ethical choices.
5. Because ethics is the key to executing projects successfully, the PMI has rolled out a Code of Ethics and Professional Conduct document to help project management practitioners do what is right and honorable.
6. The document articulates ideals to which a project manager should aspire, and defines behaviors he or she should adopt to be successful.
7. The purpose of the code is to instill confidence in the project management profession and to help an individual become a better practitioner.
8. It helps project managers make wise decisions. The code of Ethics and Professional Conduct highlights ethical values such as trust, honesty, responsibility respect and fairness.

**PART-3**

*Working in Team, Decision Making, Organizational Structure,  
Dispersed and Virtual Teams, Communication Centres,  
Communication Plans, Leadership.*

**Questions-Answers****Long Answer Type and Medium Answer Type Questions**

**Que 5.12.** | What do you understand by working in teams ? Mention various stages of team formation model.

**Answer**

1. Not all people involved in the development process like to work in groups.
2. But major software projects always have to work in groups and many people do not like to work in groups.
3. Any organization involved in the development process will have various departments reflecting its structure.
4. Formal groups can be formulated based on the different departments and task groups can be formed based on specific tasks carried.
5. Task group can contain different people from different departments to work together to carry out a specific task.
6. Every task group formed for specific activities to be carried out is dissolved once the task is completely achieved.
7. Making people work together is the most difficult task that the project manager has to carefully handle.

8. A team cannot perform instantly; it has to develop over time.

**Stages of team formation model :** Every team has to go through five different stages of development as depicted in the team formation model namely,

1. **Forming** : Basic ground rules and general behavior are set up to try and get to know each other in the team.
2. **Storming** : Grouping methods of operation have to establish as there is a chance of conflicts arising due to leadership.
3. **Norming** : A group identity emerges as the conflicts are largely settled.
4. **Performing** : How the tasks are handled by the team.
5. **Adjourning** : Disbanding of the group.

**Que 5.13.** Give categories of decisions. Also mention factors which are obstacles to good decision making.

**Answer**

**A. Categories of decisions :**

1. Decision making process can be categorized into structured and unstructured :
  - i. Structured decisions are generally simple where the rules are applied in a straight-forwards way.
  - ii. Unstructured decisions are often more complex and require a great degree of creativity.
2. The amount of risk and the uncertainty involved in the development process can affect the decision making process.

**B. Obstacles to Good Decision Making :** Few factors that affect good decision making process are :

1. **Faulty heuristics** : The rules of thumb or heuristics are useful but can be misleading. These are based on mere stereotypes.
2. **Escalation of commitment** : This happens when a wrong decision is made which cannot be altered easily later.
3. **Information overload** : Too much of information also might lead the decision process to choose a wrong one.

**Que 5.14.** What do you understand group decision making ?

Also mention obstacles to good group decision making. Give measures to reduce obstacles of group decision making.

**Answer**

1. In group discussions, different specialists and point of view of stakeholders can be brought together to make a better decision.

2. Decisions made by a team can be approved and accepted easily than decisions imposed by individuals.
3. Every group meeting takes the collective responsibility of having properly briefed of solving complex problems.
4. A group can arrive at better solutions for complex problems because the members of the group have complementary skills and expertise.
5. Group meetings provide an opportunity for people to communicate freely and easily among the members of the group.
6. Often, groups are less effective for poorly structured problems where brainstorming techniques can be used to help the groups to make it structured.
7. Even though, group decision making is effective in achieving solutions, it has been proved by research that people come up with more ideas individually than in groups.

#### **Obstacles to Good Group Decision Making :**

1. Group decision making process has its own disadvantages :
  - i. It is time consuming process.
  - ii. Conflicts can arise among the members of the group.
  - iii. Decisions can be influenced by dominant personalities.
2. Once established the group norms can survive many changes of membership in the group.
3. Experimental results have shown that people can modify their personal judgments to conform to group norms.
4. Sometimes people in groups take hasty decisions that can cause more risk when they make their decisions on their own known as risky shift.

#### **Measures to reduce obstacles of Group Decision Making :**

1. To make group decision making process to be more effective and efficient the Delphi Technique can be adopted.
2. Delphi technique endeavours to collate the judgments of a number of experts without actually bringing them face to face.
3. The set of procedures is carried out as follows :
  - i. Cooperation of a number of experts is enlisted.
  - ii. Problem is presented to the experts.
  - iii. Experts record their recommendations.
  - iv. Recommendations are collated and are reproduced.
  - v. Collected responses are recirculated.
  - vi. Experts comment on the ideas of others and modify their recommendations.

- vii. If the leader finds any discrepancy, the process is stopped; otherwise it is recirculated to the experts.
- 4. This method can be adapted to geographically dispersed experts but the process becomes time consuming.

**Que 5.15.** Write a short note on : Department structure.

**Answer**

1. Departmentalization of organizations depends on staff specialties, product lines, categories of customer or the geographical location.
2. In general, the software development process approach is referred as either function-oriented or task-oriented.
3. Function oriented approach deals with different groups that are formed based on their functional specialization.
4. This approach leads to a more effective usage of staff both technically and in employing the standards that are needed to be concerned.
5. With the task oriented approach, members are grouped together with respect to a specific task.
6. The specific task has to be achieved by the group and the group is dissolved after the successful completion of the particular task.
7. Departmentalization is also based on life-cycle phase.
8. In project life cycle phases there are separate teams for development and maintenance.
9. Matrix form of departmentalization can also be formed where there are two managers namely project manager and programming manager. The project manager deals with the day-to-day activities while the programming manager focuses on future career development.
10. Egoless programming suggests that the programmers and the programming team leaders should read other people's programs so that the programs become a common property to both.

**Que 5.16.** Write a short note on : Team structure.

**Answer**

Team structure addresses the issue of organization of the individual project teams. There are mainly three formal team structures :

**A. Chief Programmer Team :**

1. If the number of groups is larger, then the work will be slower because of increased communication. So large projects must be formalized and must be represented in a centralized structure.

2. One way to avoid this, to reduce the number of people and giving them more support to make the work done which led to the formulation of chief programmer team.
3. The chief programmer defines the specification, design, code, tests and documents the entire software.
4. The chief programmer can have a co-pilot who can assist in writing some code and discussions.
5. An editor can be used to write up the documentation drafted by the chief programmer, along with a program clerk who maintains the actual code and a tester who validates the code.
6. The disadvantage of chief programmer teams is that the chief programmer is overloaded with lots of information and cannot manage at some point of time.
7. Extreme programming concept can overcome this disadvantage where the software is developed by pairs of developers with a chief programmer / co-pilot relationship.

**Advantages :**

1. The chief programmer provides an authority, and this structure is arguably more efficient than the democratic team for well-understood problems.

**Disadvantages :**

1. The chief programmer team leads to lower team morale, since team-members work under the constant supervision of the chief programmer.
2. This also inhibits collective and their original thinking.
3. The chief programmer team is subject to single point failure since too much responsibility and authority is assigned to the chief programmer.
4. Since the chief programmer carries out many tasks individually, there is a danger of information overload on the chief programmer.

**B. Democratic Team Structure :**

1. The democratic team structure, as the name implies, does not enforce any formal team hierarchy.
2. Decisions are taken based on discussions, where any member is free to discuss with any other matters.
3. Typically, a manager provides the administrative leadership.
4. At different times, different members of the group provide technical leadership.

**Advantages :**

1. The democratic organization leads to higher morale and job satisfaction.
2. Democratic team structure is appropriate for less understood problems, since a group of engineers can invent better solutions than a single individual as in a chief programmer team.

3. A democratic team structure is suitable for projects requiring less than five or six engineers and for research-oriented projects. For large sized projects, a pure democratic organization tends to become chaotic.
4. The democratic team organization encourages egoless programming as programmers can share and review one another's work.

**Disadvantages :**

1. Democratic team structure is less productive compared to the chief programmer team.

**C. Mixed Control Team Structure :**

1. The mixed team organization, as the name implies, draws upon the ideas from both the democratic organization and the chief-programmer organization.
2. This team organization incorporates both hierarchical reporting and democratic set up.
3. The mixed control team organization is suitable for large team sizes.
4. The democratic arrangement at the senior engineer's level is used to decompose the problem into small parts.
5. Each democratic setup at the programmer level attempts solution to a single part.
6. Thus, this team organization is eminently suited to handle large and complex programs.
7. This team structure is extremely popular and is being used in many software development companies.

**Que 5.17. | What do you understand by virtual teams ? Why virtual teams are needed ?**

**Answer**

1. A Virtual Team – also known as a Geographically Dispersed Team (GDT) – is a group of individuals who work across time, space, and organizational boundaries with links strengthened by webs of communication technology.
2. They have complementary skills and are committed to a common purpose, have interdependent performance goals, and share an approach to work for which they hold themselves mutually accountable.
3. Geographically dispersed teams allow organizations to hire and retain the best people regardless of location.
4. A virtual team does not always mean teleworkers. Teleworkers are defined as individuals who work from home.

5. Many virtual teams in today's organizations consist of employees both working at home and small groups in the office but in different geographic locations.

**Need for virtual teams :**

1. Best employees may be located anywhere in the world.
2. Workers demand personal flexibility.
3. Workers demand increasing technological sophistication.
4. A flexible organization is more competitive and responsive to the marketplace.
5. Workers tend to be more productive – less commuting and travel time.
6. The increasing globalization of trade and corporate activity.
7. The global workday is 24 vs. 8 hours.
8. The emergence of environments which require inter-organizational cooperation as well as competition.
9. Changes in workers' expectations of organizational participation.
10. A continued shift from production to service/knowledge work environments.
11. Increasing horizontal organization structures characterized by structurally and geographically distributed human resources.

**Que 5.18.** Write a short note on : Communication genres.

**Answer**

1. A major influence on the nature of communication genres is the constraints of time and place.
2. Modes of communication can be categorized as combinations of two opposite : Same time/Different time and Same Place/Different Place.

	Same Place	Different Place
Same Time	Meetings, Interviews	Telephone, Instant Messaging
Different Time	Notice Boards	E-mail, Voice mail, Documents

3. The nature of the information to be conveyed :
  - i. What is the extent and complexity of the information to be conveyed ?
  - ii. Is it easy to understand ? Is the context well known to both the sender and the recipient ?
  - iii. Where the communication is personally sensitive.

4. At different stages of a project – different communication genres will be preferred.
  - i. Early stages : Meeting(s)
  - ii. Intermediate stages (design) : Teleconferencing
  - iii. Implementation stages : E-mails

**Que 5.19. | What do you understand by communication plans ?**

**Explain in brief components of communication plan.**

**Answer**

1. A communications plan, in project management, is a policy-driven approach to providing stakeholders with information about a project.
2. The plan formally defines who should be given specific information, when that information should be delivered and what communication channels will be used to deliver the information.
3. An effective communications management plan anticipates what information will need to be communicated to specific audience segments.
4. The plan should also address who has the authority to communicate confidential or sensitive information and how information should be disseminated.
5. Finally, the plan should define what communication channels stakeholders should use to provide feedback and how communication documentation will be archived as part of the project records.

**Components of communication plan :**

1. **Audience :**
  - a. A strategic communication is directed at a specific audience or set of audiences, within which there is typically a primary audience, a secondary audience and so on.
  - b. These audiences likely have different experiences with and expectations of you.
  - c. They have different levels of knowledge on the subject at hand along with different priorities and concerns.
  - d. Finally, they may have different degrees of trust in you and your organization.
2. **Context :**
  - a. Having clarified the audiences for your communication, define the context in which this communication will occur.
  - b. Recognize key events and relationships (past, present, and future) that are significant to each of the audiences you will address.
  - c. This context defines your audience world, recent experiences and reasonable expectations for the future.

**3. Outcomes :**

- a. Every business communication has a set of specific purposes to achieve, whether it's information transfer, instruction, persuasion, or transformation
- b. One technique for defining outcomes is to consider "Head, Heart, and Hands".

**4. Media :**

- a. The messages you communicate usually determine the most effective media to employ.
- b. Your choices range from intimate, personal contact to impersonal mass email, from team conference calls to all-hands town meetings.
- c. Audiences respond differently to these choices of media, especially considering the context of the communication and the outcomes you are trying to achieve.

**5. Messenger(s) :**

- a. While you are the primary messenger for most of your business communications, you still must consider whether you will be the most effective messenger.
- b. The primary consideration in choosing a messenger is "Ethos," the credibility of the messenger with the audience.

**Que 5.20.** Write a short note on : Leadership.

**Answer**

1. Leadership means the ability to influence others in a group to act in a particular way to achieve group goals.
2. A leader need not be a very good manager or vice-versa since managers have different roles such as organizing, planning and controlling.
3. It is very difficult to list the common characteristics of good leaders.
4. But every leader has a greater need for power and achievement and must have more self-control and self-confidence than others.
5. Leadership is generally based on the idea of authority or power.

**A. Positional Leadership Power :** Power can take the form based on the position of the person. Positional power can be analyzed as :

1. **Coercive power :** Ability to force someone to do something by threatening punishment.
2. **Connection power :** Based on having access to those who have power.
3. **Legitimate power :** Based on person's title giving a special status.
4. **Reward power :** Here the holder gives rewards to those who carry out tasks to the satisfaction of their leader.

- B. Personal Leadership Power :** Personal power depicts the person's individual qualities. Personal power can be analyzed as :
1. **Expert power :** Person who is capable of doing specialized tasks.
  2. **Information power :** Here, the holder has exclusive access to information.
  3. **Referent power :** Based on the personal attractiveness of the leader.

**Que 5.21.** Write a short note on : **Leadership styles.**

**Answer**

1. In order to make best use of the expertise and commitment of the people involved the leaders must be an authoritative but at the same time more flexible and tolerant.
2. Sometimes, the leaders must be democratic as well, to have a very disciplined execution of the plan.
3. Leadership styles can be classified as :
  - i. Directive vs. permissive
  - ii. Autocratic vs. democratic.
4. Directive autocrat makes decisions alone and will be person very closely associated with the implementation.
5. Permissive autocrat also makes decisions alone, but subordinates have latitude in implementation.
6. Directive democrat makes decisions participative and will be a person very closely associated with the implementation.
7. Permissive democrat also makes decisions participative, but subordinates have latitude in implementation.
8. The emphasis is that there is no one best style of leadership which has to be chosen by the management but it truly depends on the situation.





## Project Evaluation and Project Planning (2 Marks Questions)

- 1.1. What are the characteristics of software project ?**

**Ans.** Following are the characteristics of software project :

- |                 |               |
|-----------------|---------------|
| 1. Invisibility | 2. Complexity |
| 3. Flexibility  | 4. Conformity |

- 1.2. What do you understand from software project planning ?**

**Ans.** Software project planning is an aspect of project management, which reflects the current status of all project activities and is used to monitor and control the project.

- 1.3. What is the scope of a project ?**

**Ans.** In project scope, we document the project work that would help us to achieve the project goal. We document the assumptions, constraints, user expectations, business requirements, technical requirements, project deliverables, project objectives and everything that defines the final product requirements.

- 1.4. Define project plan development.**

**Ans.** Project plan development uses the inputs gathered from all other planning processes such as scope definition, activity identification, activity sequencing, quality management planning etc.

- 1.5. List the basis for software effort estimation.**

**Ans.** The basis for software estimation are as follows :

- |                             |                    |
|-----------------------------|--------------------|
| 1. Need for historical data | 2. Measure of work |
| 3. Complexity               |                    |

- 1.6. Give any two characteristics of project activity.**

**Ans.** Following are the characteristics of project activity :

1. Clarify project goals.
2. Develop a work breakdown structure.
3. Deliver realistic schedule.
4. Create a project risk plan.
5. Manage change request.

**1.7. Define portfolio management.**

**Ans.** Portfolio management is the art and science of selecting a group of investments that need long-term financial objectives and risk tolerance of a client or a company.

**1.8. Define risk.**

**Ans.** Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives.

**1.9. What are the characteristics of risk ?**

**Ans.** Its characteristics are :

1. It relates to the future.
2. It involves cause and effect.

**1.10. Write the different categories of risk.**

**Ans.** Risk can be categorized as follows :

1. Project risks
2. Product risks
3. Business risks

**1.11. Write the categories of risk on the basis of security.**

**Ans.** On the basis of security, risks can be categorized as follows :

- |                 |               |
|-----------------|---------------|
| 1. Catastrophic | 2. Critical   |
| 3. Marginal     | 4. Negligible |

**1.12. What is software risk evaluation ?**

**Ans.** Software risk evaluation (SRE) service is a diagnostic and decision making tool that enables the identification, analysis, tracking, mitigation and communication of risks in software intensive programs.

**1.13. Write the strategies for planning of risk reduction and control or risk abatement.**

**Ans.** There are five strategies for planning of risk reduction and control are :

- |                         |                         |
|-------------------------|-------------------------|
| 1. Hazard prevention    | 2. Likelihood reduction |
| 3. Risk avoidance       | 4. Risk transfer        |
| 5. Contingency planning |                         |

**1.14. Define risk transfer ?**

**Ans.** The impact of some risks can be transferred away from the project by contracting out or taking out insurance. Here, risk is transferred to another person or organization.

**1.15. What is cost benefit analysis ?**

**Ans.** Cost-benefit analysis (CBA) is a technique used to compare the total costs of a programme/project with its benefits, using a common metric.

**1.16. What are different methodologies used in project management ?**

**Ans.** Different methodologies used in project management are :

1. Agile development methodology
2. Waterfall development method
3. Rapid application method

**1.17. What are different phases of project management ?**

**Ans.** Following are the phases of project management :

1. Project initiation
2. Planning
3. Execution
4. Monitoring
5. Closure

**1.18. Define RAD.**

**Ans.** Rapid application development is a condensed development process that produces a high quality system with low investment costs.

**1.19. What is management control ?**

**Ans.** Management control is the process through which the management of an organization influences other member to implement the strategies laid down by the company.

**1.20. What are the different features of management control ?**

**Ans.** Following are the features of management control :

1. Behavioral consideration
2. Management control activities
3. Financial and non-financial performance

**1.21. What are cost-benefits evaluation techniques ?**

**Ans.** Following are the cost-benefits evaluation techniques :

1. Net profit
2. Payback period
3. Return on investment
4. Net present value

**1.22. What are the factors that affect the risk identification ?**

**Ans.** Following are the factors that affect the risk identification :

1. Application factor
2. Staff factor
3. Project factor
4. Changeover factor
5. Environment factor





## Project Life Cycle and Effort Estimation (2 Marks Questions)

**2.1. What are the stages where estimation is done ?**

**Ans.** Following are the stages of estimation :

1. Strategic planning
2. Feasibility study
3. System specification
4. Evaluation of supplier's proposals
5. Project planning

**2.2. What is parametric model of cost estimation ?**

**Ans.** Algorithmic cost modeling is also known as parametric model of cost estimation. In this model, project cost is related to some software metric which is usually size.

**2.3. How to calculate parametric model ?**

**Ans.** In parametric model, effort can be calculated as :

$$\text{effort} = (\text{system size}) \times (\text{productivity rate})$$

where size is in thousands of lines of code (KLOC) and productivity is in days per KLOC or person months per KLOC.

**2.4. Give examples of application programs, utility programs and system programs used in COCOMO.**

**Ans.** Data processing program are considered to be application programs. Compilers, linkers etc. are utility programs. Operating systems and real-time systems programs are system programs.

**2.5. What are the different categories of costs during cost estimation of project ?**

**Ans.** Categories of costs in cost estimation :

1. Development costs
2. Setup costs
3. Operational costs

**2.6. What are the basis for choosing a SDLC ?**

**Ans.** We can choose a SDLC on any one of the following basis :

1. Development speed

2. Product quality
3. Project visibility
4. Administrative overhead
5. Risk exposure

**2.7. Define evolutionary prototyping.**

**Ans.** In evolutionary / exploratory prototyping, the developer start developing the software with requirements that are best understood as this will require few changes in the prototype later on and help in exploring the unexplored requirements.

**2.8. Define throw-away prototyping.**

**Ans.** In throw-away prototyping, the prototype is developed on less well understood requirements; its main aim is that when user will use this prototype its shortcoming will help to understand the requirement more accurately.

**2.9. What are the phases in waterfall model ?**

**Ans.** Phases in waterfall model :

1. Requirements Specification
2. Software Design
3. Implementation
4. Testing

**2.10. Define Agile method.**

**Ans.** Agile method refers to a software development approach based on iterative development. Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning.

**2.11. What are the phases of Agile method ?**

**Ans.** Following are the phases of Agile method :

- |                          |                           |
|--------------------------|---------------------------|
| 1. Requirement gathering | 2. Design the requirement |
| 3. Iteration             | 4. Testing                |
| 5. Deployment            | 6. Feedback               |

**2.12. What are Agile testing method ?**

**Ans.** Agile testing method are :

1. SCRUM
2. eXtreme programming
3. Crystal
4. Dynamic software development method

**2.13. What are cost estimation techniques ?**

**Ans.** Following are the cost estimation techniques :

1. Empirical estimation techniques
2. Heuristic estimation techniques
3. Analytical estimation techniques

**2.14. Define COSMIC function points.**

**Ans.** COSMIC function points are a unit of measure of software functional size. The size is a consistent measurement (or estimate) which is very useful for planning and managing software and related activities.

**2.15. What are the phases of project management life cycle ?**

**Ans.** Following are the phases of project management life cycle :

1. Project initiation
2. Project planning
3. Project execution
4. Project closure

**2.16. What are the steps of spiral model ?**

**Ans.** Following are the steps of spiral model :

1. Identify the sub-problem with highest risk.
2. Find solution for that problem.

**2.17. What are the phases of RAD ?**

**Ans.** Following are the phases of RAD :

1. Business modeling
2. Data modeling
3. Process modeling
4. Application generation
5. Testing and turnover

**2.18. What are the objectives of software management configuration ?**

**Ans.** Following are the objectives of software management configuration :

1. Remote system administration
2. Reduced user down-time
3. Reliable data backups
4. Easy workstation setup
5. Multi-user support

**2.19. Classify COCOMO model based on development complexity ?**

**Ans.** COCOMO model based on development complexity :

1. Organic
2. Semidetached
3. Embedded

**2.20. Name the project estimation technique which is based on historical cost information.**

**Ans.** Algorithmic cost modeling project estimation techniques is based on historical cost information.





## Activity Planning and Risk Management (2 Marks Questions)

### 3.1. Write three basic objectives of scheduling.

**Ans:** The basic objectives of scheduling are :

1. It is the basis for all planning, predicting and helping management to decide how to use its resources to achieve time and cost goals.
2. It provides a basis for obtaining facts for decision making.
3. It reveals interdependencies of activities.

### 3.2. What are the key processes for developing a project schedule ?

**Ans:** Following are the key processes for developing a project schedule :

1. Define activities
2. Sequence activities
3. Estimate activity resources
4. Estimate activity durations
5. Develop schedule

### 3.3. List limitations of PERT.

**Ans:** Following are limitations of PERT :

1. Project tasks have to be clearly defined as well as their relationships to each other.
2. The PERT network does not deal very well with task overlap.
3. The PERT network is only as good as the time estimates that entered by the project manager.

### 3.4. What is milestone schedule ?

**Ans:** Milestone schedule is a summary level schedule which identifies the major milestones. They are created simply by listing the milestones as activities and giving them duration of zero.

### 3.5. What is scheduled finish date ?

**Ans:** Scheduled finish date (SF) is a point in time when work was scheduled to finish on an activity. The scheduled finish date is normally within the range of dates delimited by the early finish and the late finish date.

### 3.6. What is scheduled start date ?

**Ans.** Scheduled start date (SS) is a point in time when work was scheduled to start on an activity. The scheduled start date is normally within the range of dates delimited by the early start and late start date.

### 3.7. Explain time-scaled network diagram.

**Ans.** Any project network diagram drawn in such a way that the positioning and length of the activity represents its duration and is referred as a time-scaled network diagram. Essentially it is a bar chart that includes network logic.

### 3.8. What are risk drivers ?

**Ans.** Risk drivers are defined as something that exists in the project environment that leads one to believe that a particular risk would occur.

### 3.9. Name the various risk drivers.

**Ans.** The various risk drivers are as follows :

1. Schedule
2. Budget
3. Quality
4. Surrounding environment
5. Hardware
6. Software

### 3.10. What is forward pass technique ?

**Ans.** A forward pass in project management is a technique used to move through a project network diagram. The forward pass helps you understand the project duration and calculate the early start and early finish values.

### 3.11. Define Monte Carlo simulation.

**Ans.** Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making.

### 3.12. What is resource allocation ?

**Ans.** Resource allocation is all about identifying and scheduling resources on various activities across your project(s) to achieve your project goals. Resources in project management refer to anything you require to complete the project, including tools, equipment, facilities, or funding.

### 3.13. Why resource allocation is important ?

**Ans.** Resource allocation will help you identify and mitigate any risks, such as potential resource conflicts or gaps in availability, and manage your customers or stakeholders expectations.





## Project Management and Control (2 Marks Questions)

### 4.1. What are the tasks in project management framework ?

**Ans:** Project management framework consists of following tasks :

- |                           |                             |
|---------------------------|-----------------------------|
| 1. Project initiation     | 2. Project planning         |
| 3. Effort estimation      | 4. Time frame estimation    |
| 5. Cost estimation        | 6. Requisition of resources |
| 7. Risk management        | 8. Configuration management |
| 9. Procurement management | 10. Project monitoring      |
| 11. Project control       | 12. Evaluating alternatives |
| 13. Taking decisions      | 14. Communicating decision  |

### 4.2. List the priorities to decide levels of monitoring.

**Ans:** The priorities to decide levels of monitoring are :

1. Critical path activities
2. Activities with no delay
3. Activities with less than a specified delay
4. High risk activities
5. Activities using critical resources

### 4.3. Why change control is needed ?

**Ans:** Careful control of any changes is needed because an alteration in one document often implies changes to other documents and the system products based on that document. Even if the requirements are changing, then they must be under control.

### 4.4. What are the mechanisms used in SCM ?

**Ans:** The mechanisms or activities used in SCM are :

1. Configuration identification
2. Change control
3. Software configuration status reporting
4. Audits and reviews

### 4.5. Give three functionalities of SCM.

**Ans:** Functionalities of SCM are :

1. Give latest version of a program.

2. Prevent unauthorized changes or deletions.
3. Gather all sources, documents, and other information for the current system.

**4.6. What are the benefits of project management framework ?**

**Ans.** Following are the benefits of project management framework :

1. Consistency
2. Clarity
3. Simplification
4. Optimization
5. Communication

**4.7. Define cost management.**

**Ans.** Cost management is the process of estimating, allocating, and controlling project costs. The cost management process allows a business to predict future expenses to reduce the chances of budget overrun.

**4.8. What are the benefits of cost management ?**

**Ans.** Following are the benefits of cost management :

1. Prevents overruns
2. Avoids risks

**4.9. What are the challenges of cost management ?**

**Ans.** Following are the challenges of cost management :

1. Lacks of resources
2. Inaccurate estimation
3. Outdated technology

**4.10. Define prioritization.**

**Ans.** Prioritization is the process by which a set of items are ranked in order of importance. In product management, initiatives that live in the backlog must be prioritized as a means of deciding what should be developed next.

**4.11. What are the techniques used for determination of prioritization ?**

**Ans.** Techniques used for prioritization are :

1. Kano
2. Payback period
3. Net present value

**4.12. Define project tracking.**

**Ans.** Project tracking is a project management method used to track the progress of tasks in a project.





## Staffing in Software Projects (2 Marks Questions)

**5.1. According to Taylor what are the objectives with which to train the workers ?**

**Ans.** Following are the objectives with which to train the workers :

1. To select the best people for the job.
2. To instruct them in the best methods.
3. To give them incentives based on their performance.

**5.2. Who develop Theory X and Theory Y of organizational behavior.**

**Ans.** Donald McGregor develop Theory X and Theory Y of organizational behavior.

**5.3. How people are categorized in recruiting process ?**

**Ans.** People are categorized in recruiting process into two different types :

1. Eligible candidates
2. Suitable candidates

**5.4. What does recruitment process include ?**

**Ans.** A recruitment process must include :

- |                                  |                             |
|----------------------------------|-----------------------------|
| 1. Creation of job specification | 2. Creation of job profile  |
| 3. Obtaining applicants          | 4. Examine Curriculum Vitae |
| 5. Interviews                    | 6. References               |

**5.5. What are various motivation theories ?**

**Ans.** Following are various motivation theories :

1. Taylorist Model
2. Maslow's Hierarchy of Needs
3. Herzberg's Two-Factor Theory
4. Expectancy Theory of Motivation

**5.6. What are the three psychological states of Hackman and Oldham's job characteristics theory ?**

**Ans.** Following are the three psychological states of Hackman and Oldham's job characteristics theory :

- |                        |                   |
|------------------------|-------------------|
| Meaningfulness of work | 2. Responsibility |
| Knowledge of outcomes  |                   |

**5.7. What are the five core job characteristics of Hackman and Oldham's job characteristics theory ?**

**Ans.** Following are the five core job characteristics of Hackman and Oldham's job characteristics theory :

- |                      |                  |
|----------------------|------------------|
| 1. Skill variety     | 2. Task Identity |
| 3. Task Significance | 4. Autonomy      |
| 5. Feedback          |                  |

**5.8. Mention various stages of team formation model.**

**Ans.** Following are the various stages of team formation model :

- |               |               |
|---------------|---------------|
| 1. Forming    | 2. Storming   |
| 3. Norming    | 4. Performing |
| 5. Adjourning |               |

**5.9. Give categories of decisions.**

**Ans.** Decision making process can be categorized into structured and unstructured decisions.

**5.10. Give disadvantages of group decision making process.**

**Ans.** Following are the disadvantages of group decision making process :

1. It is time consuming process.
2. Conflicts can arise among the members of the group.
3. Decisions can be influenced by dominant personalities.

**5.11. What are the various formal team structures ?**

**Ans.** Following are the various formal team structures :

1. Chief Programmer Team
2. Democratic Team Structure
3. Mixed Control Team Structure

**5.12. What do you understand by virtual teams ?**

**Ans.** A Virtual Team – also known as a Geographically Dispersed Team (GDT) – is a group of individuals who work across time, space, and organizational boundaries with links strengthened by webs of communication technology.

**5.13. What do you understand by communication plans ?**

**Ans.** A communications plan, in project management, is a policy-driven approach to providing stakeholders with information about a project.

**5.14. What are the various components of communication plan ?**

**Ans.** Following are the various components of communication plan :

- |                 |            |
|-----------------|------------|
| 1. Audience     | 2. Context |
| 3. Outcomes     | 4. Media   |
| 5. Messenger(s) |            |

**5.15. Give classification of leadership style.**

**Ans.** Leadership styles can be classified as :

- |                             |                               |
|-----------------------------|-------------------------------|
| 1. Directive vs. permissive | 2. Autocratic vs. democratic. |
|-----------------------------|-------------------------------|

