

Course: Engineering Management

Full marks 50

Assessment 50

Total 5 chapters

100% theory

Questions 1 to 6 ab, $15 \times 6 = 90$ and 7abcd

any two $2 \times 5 = 10$ [100 full marks]pass

mark 45

1. Introduction 6 hours
2. Planning and Organizing 6 hours
3. Motivation and leadership 6 hours
4. Human resource management and control 8 hours
5. Emerging trends in engineering management 4 hours

Chapter one

What is meant by Management ?

“Management is the art of getting things done through people.”

The major resources of the organization are

- Manpower
- Machinery
- Materials
- Money

Among the entire resources of the organization manpower is very important because all other resources are mobilized and controlled by manpower. The success and the failure of any organization is depends up on the manpower. People having different experience, qualification, nature, interest, perception, attitudes are working in different post and position in the organization to achieve the common of the organization.

- So, simply, mobilizing the entire manpower in a systematic way, giving them right task is called management. Researches say that the 85% of the problem of the organization is created by the employees of the organization. So, if the employees are treated well in the organization, then most of the problems are solved. it is an art because the results of management depend upon the personal skill of managers. The art of manager is essential to make the best use of management sciences.

- Management is that field of human behavior in which managers plan, organize, staff, direct, and control human, financial resources in an organized group effort in order to achieve desired individual and group objectives with optimum efficiency and effectiveness.
- As we all know that all organizations have their own goals and objectives. While achieving the goals, organizations perform various activities like planning, staffing, leading and controlling in a systemic and effective way which is known as management.

- Management manages the organizations. It coordinates resources to get jobs done for achieving goals. Resources can be human, finance, materials and information. Management works through and with the people to get jobs done.

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- In other words
- Management is a set of activities including planning, leading and controlling directed at organizations resources like human, financial, physical, and information with the aim of achieving organizational goal effectively and efficiently in a changing environment.

Effective: completing assigned task on time

Efficient: less cost, less wastage, quality work and handling machinery properly

- Management gets jobs done through and with the people by using the processes of planning, staffing, leading and controlling to achieve goals efficiently and effectively in a dynamic environment.

- Modern concept of management says that employees must be effective as well as efficient. Effectiveness refers to completion of work or achievement of target on time. Efficiency refers to optimum utilization of resources or no wastage of resources, both are must for every organization; for example, if the annual target of a worker is to produce 1000 units of output, the employee achieves this target by wasting various resources and by mishandling the machinery then the organization will have no benefit so only effectiveness is not required. It must be accompanied by efficiency.

- In the past, management was not considered as an important part of development. With industrial revolution during 17th and 18th century, several economists expressed their 'concepts and function of management'. Only in 19th century, management became the separate field of study because business organization faced various problems regarding labour efficiency and wage payment system. In search of solution of these problems, people began to recognize management as a separate field of study.

Function of management

- Managerial function includes all managerial activities from setting objectives to taking essential steps to ensure and achieve organizational objectives. These functions are essential to create a better working environment to achieve predetermined objectives. The major functions of management include.

Planning:

- planning is the primary function of management. It involves selecting the objectives, policies, procedures and program to achieve a desired result. It is also the process of thinking before doing anything. Since it is a mental exercise and requires intelligence, skill, imagination and vision. Planning gives solution to various problems which may arise in course of functioning. It minimizes future uncertainties and risk. It saves time, effort and cost of the organization.

Planning

- Setting organizational objectives and
- Forecasting the events
- Formulating policies and procedure
- Preparing work schedules and budget

Organizing:

- organizing is the process of identifying the major activities, grouping them into jobs according to the nature and assigning the jobs to different departments and individuals. It is concerned with developing the structure and framework and arranging required resources to perform required activities. These resources include human, financial, physical and information. It defines the authority relationship among the organizational members; it is the root or base of an enterprise. Thus, it is the framework where all mechanisms involved in achieving common objective being clarified. The major activity of organizing includes
 - Identifying major activities
 - Grouping them into managerial units
 - assigning jobs to different departments and employees
 - delegating necessary authority to fulfill given responsibility

Staffing:

- staffing is concerned with recruitment, selection, appointment and placement of right person to the right job. Staffing is the life blood of an enterprise which mobilizes all other resources for the achievement of common goals. It also involves determining the size of manpower at different levels. Staffing is the continuous process for the continuous existence of an organization. Staffing includes
- Determining the total manpower requirement
- Recruitment, selection and appointment of right person to the right job.
- Organizing seminar, workshop and training to develop employee's skill.
- Performance evaluating promotion and transfer of employees.
- Remunerating employees according to their skill and ability.

Directing:

- directing is a complex function that includes all those activities which are designed to encourage a subordinate to work effectively and efficiently. It is concerned with instructing, guiding and inspiring subordinates to achieve organizational objectives. Direction is the instrument to develop a better work environment in the organization. The direction function of management includes.

a. Supervision: supervision refers to the direct and immediate guidance to the subordinates to ensure the execution of assigned works. The main motive of supervision is to ensure optimum utilization of human and physical resource so as to achieve organizational objectives. For this, a supervisor has to guide subordinates so that the latter can perform their work electively. It is a continuous process until the existence of an organization.

- **B. Motivation:** motivation is a psychological and human aspect. It is the process of stimulating subordinates to achieve predetermined goals. It is based on need and human behavior. As a social being, workers want to fulfill their basic and social needs. They might be motivated both from financial and non financial incentives.

- **C. Leadership:** leadership is the art of influencing the behavior and performance of the subordinates. It is the ability to persuade others to make them work willingly to achieve the desired goal. A person is said to be a good leader when he is able to influence others and they accept his guidance, suggestions and directions. A manager only if he is able to influence the attitude and behavior of the subordinates.

- **D. Communication:** communication is the process of transmitting ideas and information from one person to another. It is an exchange of facts, opinions, ideas, and views among two or more person. Communication is said to be effective when the message is clear. Effective communication system among all the stakeholders of an organization is essential for its successful operation, so, there must be an effective, direct, and clear communication system to follow information on various management levels.

- **E. Coordination:** coordination is the process of integrating all the units and departments of an organization. It is the process of orderly arrangement of group efforts to provide unity and people perform different functions in an organization. But the activities of different departments are interrelated to each other. Therefore, coordination among all departments is necessary to bring uniformity in action to achieve organizational goal.

Controlling:

controlling is the process of setting a standard, measuring performance, comparing actual performance with that of planned performance and taking corrective action. It is the main instrument with which uniformity in action is maintained. Taking corrective action is necessary if actual performance is not in accordance with the planned performance.

- The management implements a plan through control to ensure the achieving of predetermined goals. Therefore, it is essential to have a good controlling system for achieving results according to the plan. Controlling includes
- Setting standards
- Measuring actual performance
- Identifying deviation, if any, between actual and planned performance
- Analyzing the causes of deviation
- Taking corrective action to achieve predetermined goals.

Needs and importance of management

- Utilization of resources

Human, finance, materials and information are very important resources of organizations. All these resources are optimally utilized and used by management to achieve the organizational goal in an efficient way. All resources should be equally coordinated to find out the good outputs.

- Goal achievement

Achieving goals of organizations is very important thing in management. Management performs various activities like staffing, directing, communicating, planning ect to achieve the goals of the organizations.

- Problem solving

There may be various misunderstanding and problems in organizations while performing various activities.

Management solves organizational problems. It identifies and analyzes the problems and takes actions to solve it by choosing the best alternative.

- Performance of control

Management sets the standards of work performance in organization. It measures and evaluates the actual performance. It takes corrective action for deviations.

Creating job opportunity

Revenue collection for government

Scope of application of Management

- The scope and application of management is too wide to be covered in a few pages. It is very difficult to precisely state the scope of management. However, management includes the following aspects:-
 - **Economic Resource**
 - **System of Authority**
 - **Functional Areas of Management**
 - **Management is an Inter-Disciplinary Approach**
 - **Principles of Management**
 - **Management is an Agent of Change**
 - **The Essentials of Management**

Economic Resource

- Business Economics classifies the factors of production into four basic inputs, viz. land, labour, capital and entrepreneur. By the use of all these four, basic production can be done. But to turn that into a profitable venture, an effective utilization of man, money, material, machinery and methods of production has to be ensured.
- This is guaranteed by the application of management fundamentals and practices. The better is the management of an enterprise; the higher is its growth rate in terms of profit, sales, production and distribution. Thus management itself serves as an economic resource.

System of Authority

- As already discussed, management is a system of authority. It formalizes a standard set of rules and procedure to be followed by the subordinates and ensures their compliance with the rules and regulations. Since management is a process of directing men to perform a task, authority to extract the work from others is implied in the concept of management.

Functional Areas of Management

- Management covers the following functional areas:-

Financial Management: Financial management includes forecasting, cost control, management accounting, budgetary control, statistical control, financial planning etc.

Human Resource Management: Human Resource Management covers the various aspects relating to the employees of the organization such as recruitment, training, transfers, promotions, retirement, terminations, remuneration, labour welfare and social security, industrial relations etc.

Marketing Management: Marketing management deals with marketing of goods, sales promotion, advertisement and publicity, channels of distribution, market research etc.

- **Production Management:** Production Management includes production planning, quality control and inspection, production techniques etc.

Material Management: Material management includes purchase of materials, issue of materials, storage of materials, maintenance of records, materials control etc.

Purchasing Management: Purchasing management includes inviting tenders for raw materials, placing orders, entering into contracts etc.

Maintenance Management: Maintenance Management relates to the proper care and maintenance of the buildings, plant and machinery etc.

- **Office Management:** Office management is concerned with office layout, office staffing and equipment of the office.

- **Management is an Inter-Disciplinary Approach**
- Though management is regarded as a separate discipline, for the correct application of the management principles, the study of commerce, economics, sociology, psychology, and mathematics is very essential. The science of management draws ideas and concepts from a number of disciplines making it a multi-disciplinary subject.
- **Principles of Management**
- The principles of management are of universal application. These principles are applicable to any group activity undertaken for the achievement of some common goals.

- **Management is an Agent of Change**
- The techniques of management can be improved by proper research and development.
- **The Essentials of Management**
- The essentials of management include scientific method, human relations and quantitative techniques.

Features of management

- **Management is goal oriented**

Management is a means to achieve predetermined goals. All managerial activities are systematically directed in the accomplishment of such goals. Management has no justification to exist without goals. Effective management is always management by objective. The basic goal of management is to maximize effectiveness and efficient of human efforts. The success of management is measured by the extent to which the established goals are achieved. Hence, management is goal oriented.

- **Management is a group activity**
- Management cannot be done in isolation. It always refers to group efforts. Whenever there is an organized group of people working towards a common goal, some type of management become essential. A group can easily and effectively attain the goal or objectives of an organization rather than individuals.

- **It is a distinct process**
- Management is a distinct process performed to accomplish organizational goals by the use of human and material resource. The chief function of manager is not to do but to get things done through others. Mary Parker Follet has said, management is the art of getting things done through people.

- **Management is a universal activity**
- Management is required in all types of organization. Wherever there is a human activity there is a management. The basic principle of management is applicable in business as well in other organizations. These principles are flexible and are modified according to needs and environment of the organization.

- **Management is an integrating process**
- The essence of management is integration of human and other resources for effective performance. It integrates men, machines, and materials for carrying out the operations for achieving the stated goals. The responsibility of management is welding the three factor men, methods and machinery into a single working factor.

- **Management is a social process**
- Management is a social process because it consists of getting things done through others. This involves dealing with people. The efforts of human being have to be directed, coordinated and regulated by management. Moreover, management has a social obligation to make optimum use of scarce resources for the benefit of the community as a whole.

- **Management is both science and art.**
- Management is a science because it has developed certain principles there are universal application, it is also an art because the results of management depend upon the personal skill of managers. The art of manager is essential to make the best use of management sciences. Hence, it is both science and art.

- **Management is a profession**
- Management is now regarded as a profession. It has a systematic and specialized body of knowledge, principles and techniques, which can be taught well as applied in practice. With the increase in joint stock companies, and multinational companies, the management is entrusted in the hands of profession managers.

- **Management is multidisciplinary discipline**
- Management draws knowledge and concepts from other disciplines such as economics, psychology, sociology, statistics; operation research etc. management integrates the ideas and concepts taken from other disciplines and uses them in managing the organization.

- **Management is intangible**
- Management is unseen forces but its results are apparent. The effectiveness of management is judged on the basis of the end result through operations cannot be observed.

- **Management is dynamic**
- Management is a dynamic function and it has to be performed continuously. it operates in an ever changing environment. Management adapts itself to environmental changes and also introduces innovation in methodology.
- In the past, management was not considered as an important part of development. With industrial revolution during 17th and 18th century, several economists expressed their concepts and function of management. Only in 19th century, management became the separate field of study because business organization faced various problems regarding labor efficiency and wage payment system. In search of solution of these problems, people began to recognize management as a separate field of study.

- **Management is universal**
- Management is applicable to all forms of human organizations whether it is profit- making or non- profit making. Management is not applicable to business undertakings only. It is applicable to political, social, religious and educational institutions also. Management is necessary when group effort is required
- **Management is a social process**
- To get things done from the people manager has to establish inter-personal relations with them. He has to understand the behavior of all as individual members as well as members of a group. Management is a process, function or activity. This process continues till the objectives set by administration are actually achieved.

“Management is a social process involving co-ordination of human and material resources through the functions of planning, organizing, staffing, leading and controlling in order to accomplish stated objectives”.

- **Management is dynamic, and not static**
- Management is not a stereotype activity but is ever changing. It is a complex and dynamic activity. Management adapts itself to changes in environment, and also initiates and introduces changes i.e. Innovations, change in methodology etc.
- Management is a purposeful activity. It coordinates the efforts of workers to achieve the goals of the organization. The success of management is measured by the extent to which the organizational goals are achieved. Management is concerned with directing and controlling of the various activities of the organization to attain the pre-determined objectives.
- Every managerial activity has certain objectives. In fact, management deals particularly with the actual directing of human efforts.

- **Continuous process**
- Management is not one time activity, but it is continuous activity. The cycle of management continues to operate so long as the organizations continue to exist

- **Management is an integrating/unifying force**
- Management is integrating people into a single working force with available physical resources. The essence of management is the integration of human and other resources to achieve the desired objectives. Managers seek to harmonize the individuals' goals with the organizational goals for the smooth working of the organization.

Principles of management

- The practice of management is based on specific disciplines which are known as principles of management. And these management principles are the facts and truths gained through observation and experiment. Simultaneously, various scholars have introduced many principles in different times through their research and investigation. Among them, Henry Fayol has recommended fourteen principles of management.

Division of work:

- this principle is similar to the famous economist, Adam Smith's principle of division of labour. According to this principle, every employee in an organization must be assigned only a specific type of work to increase efficiency. The development of specialization ensures simplicity and accuracy in performance.

Authority and responsibility:

- authority and responsibility are two interrelated terms in management. While authority is the power and right inherent in a managerial position through which a manager commands subordinates, similarly responsibility is the obligation to be fulfilled by the subordinates. This principle emphasizes on the balance between authority and responsibility. Authority without responsibility can make a person irresponsible and there is possibility of misuse of power. Similarly, responsibility without proper authority makes a person ineffective.

Discipline

- : discipline means obedience to superiors and their guidelines. It is also concerned to follow the rules, regulations and procedures of an organization. This principle is applicable to managers and subordinates alike because all are within the rules of the organization. Since the discipline is a must to develop a feeling of self responsibility among the members. The manager has to maintain disciplined environment in the organization.

Unity of command

- : according to this principle every workers/ subordinates must get orders and instructions only from one superior at a time. It means a subordinate should be accountable to a single superior at a time. Further, this principle is essentials to fix the responsibility and avoid confusion. For instance, when a subordinate receives orders and instructions from more than one superior at a time, the will get confused. In such a situation, he cannot fulfill his responsibilities efficiently and may commit mistakes.

Unity of direction

- : unity of direction implies that there should be one head and one plan for a group of activities having a common objective. There must be only plan for common work and one in charge to coordinate all the members of the unit. This unity of direction, thus, is essential to maintain unity in action or operation.

Subordination of individual interest to general interest

- : individual interest means fulfillment of employee's objectives, while general interest means the fulfillment of organizational objectives. This principle concentrates on the basis management philosophy that individual objectives of employees are subordinate to the common objectives because achievement of group objectives in the long run helps to fulfill individual objectives, hence, it is essential to reconcile individual objectives with that of group objectives.

Remuneration of personnel

- : it is the reward paid to the employees for their contribution. The remuneration should be acceptable both to the management and the employees. Wages should be determined by considering employees responsibilities, cost of living and financial condition of the organization. Basic wage should be fixed, beside, there should be a provision of monetary and non monetary incentive.

Centralization and decentralization

- : centralization is the retention of decision making authority at the top level management. On the other hand decentralization is the systematic division of decision making authority from top to bottom in a hierarchy. Maintaining centralization or decentralization depends upon the nature and size of the organizations and also the knowledge and capability of subordinates. Generally, in small organizations where the range of activities is limited, centralization is preferred whereas in large organization decentralization is preferred.

Scalar chain

- : the scalar chain refers to the unbroken line of authority of top to bottom in hierarchy. This principle is important for systematic and orderly communication of information in an organization; information has to be communicated through successive chain from top to bottom or vice versa. According to the Fayol, the scalar chain must be strictly followed except in emergencies. Fayol also has suggested the concept of Gang Plank to avoid delay in communication among the same level of employees.

Order

- : this principle is concerned with the systemic arrangement of materials and people. Fayol has classified order into two types, material order and social order. And placing machines and other physical things in proper place and quantity is material order, and placing right person to the right job is called social order. The material order emphasizes that all physical resources necessary for proper functioning must be available at the right place at the right time. Similarly, social order emphasizes that all necessary members must be available on the proper place. As a result, this principle is essential to minimize the wastage of time and resources.

Equity

- : this principle is concerned with kindness and justice to all the employees working in an organization. Being in the equity, management has to realize that loyalty and devotion can be extracted from the members only through kindness and justice. Obviously, it is helpful in developing a feeling of responsibility among the employees. Therefore, being concerned in it, management has to avoid the concept of favoritism and partiality among the employees.

Stability of tenure

- : according to this principle, employees must have a feeling of security of their job to continue the work efficiently. Instability of employees is the cause of poor management whereas the stability of employees helps to develop experience and efficiency. The feeling of job insecurity among the employees creates problems of high labour turnover, increased cost of selection, training, supervision.

Initiative

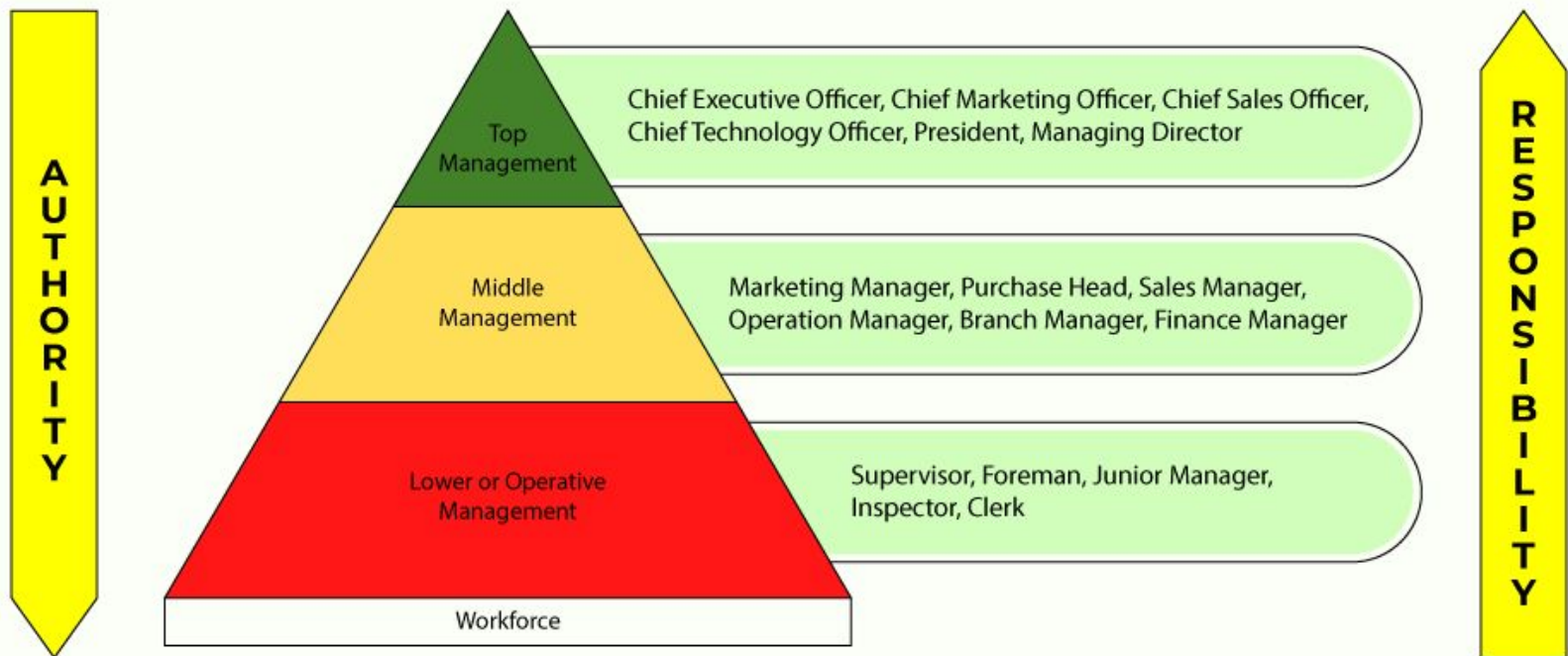
- : according to this principle, every employee should be given reliable freedom to exercise judgment in formulation and execution of plans. Obviously, employees do not expect any kind of interruption or guideline from superiors for minor technical work; instead, they want to fulfill their responsibility in their own risk and knowledge. For instance, freedom provides a sense of self motivation among the employees making them more dedicated and loyal towards the organization.

Esprit De Corps

- : Esprit De Corps is proverb that means union is strength. It is possible only through harmony and mutual understanding among the workers. According to this principle, the manager has to take necessary steps to promote team spirit and develop a feeling of harmony among each other. Managers have to attain organizational objectives through group effort. To do so, Fayol suggests two concepts to the managers, firstly, the concept of divide and rule, which much be avoided, and secondly emphasis must be given unity of command and oral communication amount the workers to improve human relations.

Level of management

- The chain of superior-subordinate relationships is known as the Levels of Management. The three levels of management are Top Level Management, Middle-Level Management, and Operational Level Management. Operational level is also called lower level management.



LEVELS OF MANAGEMENT

1. Top Level Management

- The senior most executives of the organization are found at the top level of management. The top level of an organization's management consists of the Board of Directors, Managing Director, Chairman, Chief Executive Officer, Chief Operating Officer, Vice-President, President, General Manager, and other Senior Executives. The managers at the top level of management of an organization are responsible for its survival and welfare. These managers perform stressful and complex work that demands long hours and commitment towards the company.

Functions of the Top Level Management

- i) Determination of the objectives for the organization: The managers at the top level management formulates the goals or objectives for an organization along with the strategies to achieve those goals.
- ii) Formulating plans and policies: For the achievement of the pre-determined goals or objectives of an organization, it is essential to formulate proper strategies, plans and policies within the organization. The top level managers are responsible for the formulation of these plans and policies.

- iii) Coordination and control of the performance: Based on the overall pre-determined objectives of the organization, the top level managers coordinate and control different activities of different departments of the organization.
- iv) Analysis of the business environment: Business environment of an organization plays a crucial role in its success and survival. The managers at the top level of management of an organization carefully analyze the business environment and its implication and make necessary decisions for better results.

- v) Setting up an organizational framework: For the success and survival of an organization, it is essential to form a proper framework or structure within the company. The top level managers are responsible for the determination of the organizational framework for the proper and successful execution of its plans and policies.
- vi) Assembling of the resources: Achievement of the organizational goals requires different resources of materials, machines, manpower and money. It is the duty of the managers at the top level management to arrange these resources

2. Middle Level Management

- The next level of management is the Middle Level, which serves as a link between the Top Level Management and the Lower Level Management. The middle level management is superior to the lower or operational level management and subordinate to the top level management. The middle level of an organization's management consists of different functional department heads, such as Departmental Managers including Production, Purchase, Finance, Personnel, Marketing Managers, and other executive officers for different departments. The employees or members of the middle level management are responsible to the top level management for their performance.

Functions of the Middle Level Management

- i) Interpretation of the policies formulated by the Top Level Management: As the middle level management acts as a subordinate to the top level management, the managers at this level have to clearly explain the plans and policies formed by the managers at the top level management to the managers at the lower or operational level management.
- ii) Selection of suitable operative and supervisory employees: To perform any function properly, an organization needs the required employees. It is the duty of the Middle Level Managers to make sure that the organization has sufficient employees with them to perform the functions and duties better. For the fulfillment of this duty, the middle level managers recruit and select suitable employees for different departments based on the applicant's skills, etc., and the firm's requirements.

- iii) Assigning of duties and responsibilities to the Lower Level Management: The middle level managers acts as superior to the operational level managers. These managers have to assign respective duties and responsibilities to the lower level managers and coordinate with them regarding the activities of different work units.
- iv) Motivating employees to get desired objectives: An organization can effectively and efficiently achieve its desired goals only when its employees are motivated enough to work towards the betterment of the organization. Therefore, the managers at the middle level management motivate the employees towards the achievement of the organizational goals and improvement of their performance.
- v) Cooperating with the entire organization: As middle level management serves as a link between the top level management and the lower level management, the managers at this level have to cooperate with every other department for the smooth functioning of the organization.

3. Lower Level Management

- The last level of management is the lower level management and is also known as the Operational Level Management. The managers at the lower level of management play a crucial role in the proper management of an organization, as they directly interact with the actual work force and interpret the instructions of the middle level managers to them. The responsibility and authority of the lower level managers depend upon the plans and policies formed by the top level management. The lower level management consists of foremen, supervisors, section officers, and other managers who have direct control over the operative employees of the organization.

Functions of the Lower Level Management

- i) Issuing of orders and instructions: The managers at the operational level management issue orders to the workers and supervisors and instructs them on their roles, responsibilities, and authority. Besides, these managers also control the functioning of the workers.
- ii) Preparation of plan for activities: The lower level managers plan the day-to-day activities of the organization. Besides, these managers also assign work to the subordinates, guide them for the same, and take corrective measures wherever and whenever necessary.

- iii) Assigning and assisting in work: The job or responsibility of the lower level managers includes assigning work to the subordinates and assisting them with the work. They do so by explaining the work procedure to the employees and solving their problems for better performance.
- iv) Representing workers' grievances: As the managers at the lower level management are in direct contact with the managers at the middle level management, they listen to the grievances of the workers and report those issues to the middle level managers.

- v) Ensuring a safe and proper work environment: The lower level managers are responsible for providing the work force with a safe and proper work environment. They also have to maintain proper discipline and a good atmosphere within the organization, as it motivates the employees to work towards the accomplishment of the organizational goals.
- vi) Helping the middle level management: The managers at the operational level management helps the middle level managers in selecting, training, placing, and promoting the workers of an organization as they can give a direct insight as to what is required for the achievement of the organizational goals and about the performance of the workers.

- vii) Encourage initiative of employees: The best way to motivate employees and make them feel an important part of the organization is by encouraging them to take initiative. The lower level managers do so by welcoming their suggestions and ideas and by rewarding them for the good ones.

Scope of management

- The scope of management refers to the range of activities, tasks, and responsibilities that a manager oversees within an organization. It defines the boundaries within which a manager operates and makes decisions. The scope can vary depending on the level of management (e.g., top, middle, or lower), the size of the organization, and the specific department or function.

Here are the key components typically included in the scope of management:

- 1. Planning: Setting organizational goals, determining the best strategies to achieve them, and allocating resources.
- 2. Organizing: Structuring the organization, assigning tasks, defining roles, and establishing authority and relationships among employees.

- 3. Leading: Directing and motivating employees to achieve organizational goals. This includes communication, motivation, leadership styles, and conflict management.
- 4. Controlling: Monitoring performance, comparing it with the set standards, and taking corrective actions if necessary.
- 5. Decision-Making: Making choices regarding resources, investments, strategy, staffing, and other organizational needs.

- 6. Human Resource Management: Involves recruiting, training, developing, appraising, compensating, and ensuring the well-being of employees.
- 7. Communication: Ensuring a smooth flow of information both within the organization and externally with stakeholders.
- 8. Resource Allocation: Efficiently allocating resources like time, money, manpower, and technology to maximize productivity and meet organizational objectives.

- 9. Coordination: Ensuring that different departments or teams work together harmoniously to achieve the organization's objectives.
- 10. Risk Management: Identifying, analyzing, and mitigating risks that can affect the organization's objectives.
- Each of these components defines the broad responsibilities of a manager and highlights the scope within which management operates to ensure organizational success.

Concept of organization

- Organization is an association of two or more individuals working together to achieve a common goal; or, in other word, an organization is a collection of people working together in a division of labor to achieve a common objective. When people decide to accomplish any work or job, they need to form an organization. So, it is a social aspect of an essential part of human life. Thus, the concept of organization has been developed from the very beginning of human civilization since people started living in group of families. Nowadays, people form different types of organizations on the basis of their goal consisting of business, social, political, religious, clubs and so on.

- In fact, a job that cannot be performed by a single person can be performed effectively in a group. So, people used to organizations when they could not perform the job solely in an effective manner. Conclusively, people form an organization on the basis of their common goals, to make division of work on the basis of efficiency, to delegate authority and responsibility, to maintain communication among them, to coordinate the activities among them and to coordinate the activities among all the members. Briefly, an organization promotes collaboration and negotiation among individuals in a group and improves the effectiveness and efficiency in performance to achieve common goals.

- organizations have the structured setting where people work together to achieve common goals. Within the organization there should be clear definition of authority and responsibility among the members. Depending upon the size, organizations complexity have in structure and in division of responsibility and authority. And, they work in a dynamic environment by applying technology to convert inputs into output.

Features of organization

- 1. Collection of people: The concept of organization comes into existence when two or more people come together to accomplish a definite goal. Therefore, organization is a human association in which, people interact with each other to produce a synergic effect and develop a network to communicate information and to maintain unity in work. So, it is essential for effective performance of the enterprise.

- 2. Common goal: The basis of an organization is a specific goal and it serves as a reason of its existence. All the activities of involved members, concentrate on the fulfillment of a common goal. Possibly, it binds the members and motivates them to devote their effort in the best way.

- 3. Division of work: The total work is divided into small units on the basis of their nature in an organization. Each work is assigned to different individuals according to their skills, abilities and experiences. These individualities enable them to develop the concept of specialization and also contribute to develop their working efficiency.

- 4. Coordination: Coordination is the process that integrates the functions of different units of an organization. In an organization, there should be good coordination among the departments and members through executive leadership. Therefore, it is essential to achieve uniform progress of works in each unit. It helps to minimize the duplication and overlap of effort.

- 5. Hierarchy of authority: Organization consists of a formal structure in which hierarchy of authority of each member is clearly defined. The hierarchy of authority is formed on the basis of degree of responsibility and accountability. It clarifies the role of each individual from top to the subordinate levels. Higher level job needs more skill, experience and responsibility by implementing a chain of command to see the work progress of respective subordinates.

- 6. Perpetual existence: An organization is formed for an indefinite period to perform business for a long period of time. An organization continues its existence and operation even while changing in structure, membership, objectives and management. For this, flexibility and adjustment in the line of business in accordance with changing environment is essential. However, a static and unadjustable organization cannot exist for a long period of time.

- 7. environment: an organization performs activities in a dynamic environment. It consumes resources from environment and also exports output to it. The survival and continuance of an organization is assessed in terms of how well it serves in the challenging environment. Basically, impact of external environments like political, economic, socio cultural and technology must be taken into consideration.

- 8. Technology: technology refers to new knowledge, skill, ideas, procedures, equipment and tools. It is essential to convert raw materials into finished products. In an organization people use new technology to perform their activities. The use of appropriate technology in a job helps to develop working efficiency and also helps to minimize the cost of the output.

Formal and informal organizations

- An organization is a network of relationships among individuals working together in an enterprise. In terms of relationship, organizations can be classified into two types formal and informal organizations.
- **Formal organization**
- Formal organization is established in planned way. An organization is formal when the activities of two or more persons are consciously coordinated towards a common goal. Formal organization means the intentional structure of roles in a formally organized enterprise. The formal organization refers to the structure of jobs and positions with clearly defined functions and relationships as prescribed by the top management. This type of organization is built by the management to realize the enterprise objectives. It lays down the functions, authority and responsibility of every individual.

- The usual way of depicting a formal organization is by means of organizational chart. It is a snapshot of an organization that shows the flow of authority, responsibility, and communication among various departments, which are located at different levels of the hierarchy. The basic characteristic of organization is as follows.

- It is deliberately (intentionally) created by the top management.
- It is based on division of work or specialization
- It defines clearly the authority and responsibility of every position.
- It is developed through delegation of authority.
- it specifies the communication line
- it has written rules and procedures
- It focuses on jobs to be performed.
- it is shown on the organization chart of the company

Informal organization

- Informal organization is the result of human interaction at work place. Informal organization originates from within the formal organization to meet the cultural and social needs of members of the organization. When a number of people work together in a formal group, they develop personal and social relationships on the basis of their likes and dislikes. They associate informally to fulfil their needs. These groups are not pre planned but develop automatically within the formal organization.

- The informal organization is thus a system of social relationships among the members. The informal organization refers to people in group associations at work, which is not specified in the formal organization chart. It is natural groupings of people in work situation. These social groups are usually based on caste, language, culture, emotions, interest; similarity of work etc. According to Keith Davis an informal organization has a powerful influence upon productivity and job satisfaction.

- Informal organization has great impact upon the productivity and work satisfaction of the members. In every organisation both formal and informal systems are necessary for group activates, just as two blades are essential to make pair of scissors workable. Hence, there cannot be a completely formal or informal organization. The basic characteristics of informal organization are given below.
- it is unplanned
- it reflects human or social relationships among people
- it is based on common interest, language, religion, culture etc
- The membership of informal organization is voluntary.
- It has no written rules and regulations.
- It is not shown on the organization chart.

Virtual organization

- A virtual organization is a business model where geographically spread teams and individuals collaborate and function as a unified entity through the use of information and communication technologies (ICT). Unlike traditional organizations, virtual organizations don't have a physical office or centralized location. They depend on digital communication, cloud-based tools, and other online resources to manage operations, projects, and workflows.

- Key characteristics of a virtual organization include:
- 1. Remote Collaboration: Employees or partners work from different locations, often across countries or time zones.
- 2. ICT-Driven: The use of communication tools such as email, video conferencing (e.g., Zoom, Microsoft Teams), instant messaging, and project management platforms (e.g., Slack, Trello) is essential for coordination.

- 3. Flexible Work Environment: There is typically more flexibility in working hours and locations, which can boost work-life balance.
- 4. Cost Efficiency: By eliminating the need for physical office space and other overhead costs, virtual organizations can reduce expenses.

- 5. Global Talent Pool: Virtual organizations can hire talent from anywhere in the world, allowing them to attract highly skilled individuals without being limited by geography.
- 6. Quickness and Scalability: virtual organizations can quickly adapt to market changes or scale up/down based on demand.
- Examples of virtual organizations include companies like Gitlab, Automatic, and Buffer, which all operate with fully remote items.

What is Engineering Management?

- Engineering management is the application of the practice of management to the practice of engineering. Engineering management brings together the technological problem-solving ability of engineering and the organizational, administrative, legal and planning abilities of management in order to oversee the operational performance of complex engineering driven enterprises. A Master of Engineering Management (MEM) is sometimes compared to a Master of Business Administration (MBA) .

"The art and science of creating value by using technology together with other resources of an organization is engineering management"

- Engineering management covers the gap between engineering and business management, namely the combination of technical and economic decision-making with analytical skills, optimization capabilities, and technical product development.

- Engineering management skills allow engineers to direct their work with tact, compassion, and thoughtful strategic planning to boost safety, optimize project finances, make environmentally conscious decisions, support team members, maintain diverse, equitable, and inclusive workplaces, and more.

ICT, or Information and Communication

- Technology, refers to the technologies that provide access to information and facilitate communication. This includes hardware (like computers, mobile devices), software (applications and systems), networks (like the internet), and services (such as cloud computing). ICT is a broad field that encompasses many areas, including:

- 1. Telecommunication: Mobile networks, fiber optics, and other forms of communication technology.
- 2. Information Systems: Databases, websites, and enterprise systems.
- 3. Computing: Personal computers, servers, and other computing devices.
- 4. Internet: Email, social media, cloud storage, and web browsing.

- 5. Software Development: Creating programs and applications.
- 6. Networking: Local and wide-area networks, internet access, and network security.
- 7. Artificial Intelligence (AI): Machine learning, data analysis, and automated decision-making.
- ICT plays a crucial role in nearly every aspect of modern life, from business and education to healthcare and government operations.

Importance of management in technology driven environments

- In a technology-driven environment, effective management is crucial to connect the full potential of technological advancements and maintain a competitive edge. Here's how management plays a vital role:
- 1. Strategic Direction and Vision: In technology-driven environments, rapid changes are the norm. Management helps set a clear vision and direction, ensuring that technology aligns with the organization's goals and creates value rather than just following trends.

- 2. Innovation and Adaptability: Management promotes a culture of innovation and continuous learning, essential in an environment where technologies change quickly. Effective leaders encourage experimentation, manage risks, and adapt strategies as needed to stay relevant.
- 3. Resource Allocation/ budgeting : Management oversees the allocation of resources, ensuring the necessary investments in technology, training, and infrastructure. In tech-heavy settings, this means balancing budgets while investing in high-impact technologies that bring measurable returns.

- 4. Talent Development and Retention:
Technology-driven organizations require skilled, adaptable talent. Management plays a role in recruiting, developing, and retaining this talent through professional development, training programs, and a supportive culture that fosters growth and innovation.

- 5. Change Management: New technologies often require shifts in workflows, culture, and skill sets. Managers guide organizations through these changes, ensuring a smooth transition, minimizing resistance, and addressing employee concerns effectively.
- 6. Data-Driven Decision Making: Modern management emphasizes using data and analytics to inform decisions. In a tech-driven environment, managers must understand and control data insights to improve efficiency, forecast trends, and make more accurate decisions.

- 7. Risk Management and Cybersecurity: With technology comes risk, including cybersecurity threats. Management ensures that the organization has strong policies, protocols, and technologies in place to protect sensitive data and maintain compliance with industry standards.
- 8. Sustainability and Ethical Considerations: Technology can have environmental impacts, and management is responsible for overseeing sustainable practices, such as reducing energy use, ethical sourcing, and corporate social responsibility. This is crucial for long-term sustainability and reputation management.

- 9. Customer-Centric Innovation: Managers are responsible for understanding customer needs and ensuring that technology investments improve customer experiences and deliver real value, which is essential in maintaining a competitive edge in a tech-driven market.
- In summary, management serves as the backbone of a technology-driven environment, driving innovation, ensuring alignment with organizational goals, and managing the complexities and risks that come with rapid technological change.

Why Are Management Skills Important for Engineers?

- As an engineer, you work on complex and expensive projects, use advanced (and often, dangerous) machinery and equipment, collaborate with a diverse team, and influence solutions that have an environmental or social impact. Engineering management skills allow engineers to navigate their work with tact, compassion, and thoughtful strategic planning to boost safety, optimize project finances, make environmentally conscious decisions, support team members, maintain diverse, equitable, and inclusive workplaces, and more.

- As individual contributors, engineers are good at solving technical problems. However, they're often not as strong at communicating the value of technology, leveraging data science techniques to make evidence-based decisions, or leading and inspiring teams of diverse people with empathy and inclusiveness.

- Management skills can help engineers overcome the universal concerns. These skill sets are transferable and applicable in all engineering industries, including mechanical, civil and environmental, aerospace and aeronautical, chemical, biomedical, industrial, and petroleum. An engineer with all-encompassing management skills is able to see the bigger picture. Engineers in leadership roles can identify and prioritize the balance between safety, efficiency, and profit, ensuring a fully rounded project. Engineering managers can connect the technical operation of the technological product or service to its economic outcomes, thereby seeing opportunities that others cannot see.

- Engineering managers are experienced engineers who currently manage technical activities in both large and small organizations. No matter the size of the company, an engineering manager makes decisions that are part of the management chain of command and impact the success of technical activities. Making data-based technical decisions is at the core of what an engineering manager does. The success of an engineering manager's career depends on these decisions. And in today's ever changing technology-based world, these decisions are not easy.

- Thus, engineering management is an in-demand, growing field that's constantly evolving to accommodate modern technical concepts like artificial intelligence (AI) and big data and other technologies emerging from the fourth industrial revolution. Engineering managers are needed in project management, director, and executive roles across engineering fields, including mechanical, civil, environmental, chemical, biomedical, biotech/pharma, industrial, aerospace, aeronautical, and petroleum engineering. Aspiring engineering managers will play a valuable role in the key technical decisions that will help these industries adapt to an ever changing technological world.

- If you aspire to advance your engineering career, an engineering manager role can pave the way for many diverse leadership opportunities. The duties of an engineering manager include planning, designing, and overseeing projects, as well as managing finances and supervising one or more engineering teams. The higher the engineering manager rises up the technical management ladder, the more engineering teams and managers fall under him/her. The work of an engineering manager requires a combination of skills and knowledge including engineering expertise, personnel management, leadership skills, and financial and business acumen.

Engineering functions in organizations

- In an organization, the engineering function plays a crucial role in ensuring the design, development, implementation, and maintenance of systems, products, and processes. Engineering functions vary depending on the industry, but they typically focus on applying scientific principles to solve problems and improve efficiency. Here are the primary engineering functions within an organization:

- 1. Research and Development (R&D) (Product development)
- Purpose: Responsible for innovation, product development, and improving existing products or services.
- Tasks: Conducting research to explore new technologies, creating samples, and testing products or systems.
- Example: Developing new materials, product features, or more efficient manufacturing processes.

- 2. Design and Analysis

- Purpose: Creating detailed plans, models, and specifications for new products, systems, or infrastructure.
- Tasks: Designing mechanical systems, electrical systems, software, or infrastructure. Using computer-aided design (CAD) software for simulations and stress testing.
- Example: Designing a new product such as an automobile component or a software system, including analysis of its performance.

- 3. Manufacturing and Production Engineering
- Purpose: Focusing on the efficient production of products or the delivery of services.
- Tasks: Developing and optimizing production processes, improving factory layout, equipment design, and ensuring product quality.
- Example: Setting up assembly lines, ensuring machinery operates at optimal capacity, and reducing waste.

- 4. Quality Control and Assurance

- Purpose: Ensuring that products and processes meet the required quality standards and specifications.
- Tasks: Inspecting materials, parts, and products, testing product durability, and implementing quality management systems.
- Example: Conducting tests to ensure that manufactured products meet international quality standards (ISO).

- 5. Maintenance Engineering
- Purpose: Ensuring that equipment and machinery function effectively with minimal downtime.
- Tasks: Managing preventive maintenance schedules, troubleshooting, and repairing machinery or systems.
- Example: Maintaining machinery in a factory or managing the maintenance of a fleet of vehicles.

- 6. Project Management

- Purpose: Overseeing engineering projects from initiation to completion, ensuring they are delivered on time and within budget.
- Tasks: Coordinating teams, resources, and timelines, as well as managing risks and communication.
- Example: Managing the construction of a new plant or the implementation of new software across a company.

- 7. Technical Support and Service
- Purpose: Providing support to both internal teams and customers to solve technical problems and improve product performance.
- Tasks: Troubleshooting equipment, providing training to end users, and implementing upgrades.
- Example: Offering customer support for complex machinery or assisting with system upgrades in an IT department.

- 8 Safety and Compliance

- Purpose: Ensuring that engineering projects and operations comply with safety regulations and industry standards.

- Tasks: Developing safety protocols, conducting risk assessments, and implementing corrective actions to prevent accidents.

- Example: Ensuring compliance with occupational health and safety regulations or managing environmental impact assessments.

- 9. Supply Chain and resource management:
Managing the efficient flow of materials, components, and products from suppliers to the customer.
- Tasks: Designing supply chain systems, improving logistics processes, and optimizing inventory management.
- Example: Implementing just-in-time (JIT) manufacturing practices or improving warehouse automation.

- 10. Systems Integration (operations)
- Purpose: Ensuring that different systems, both hardware and software, work together smoothly and continuously.
- Tasks: Coordinating between multiple teams or systems, ensuring that all components of a project are compatible and functional.
- Example: Integrating software platforms in an organization or ensuring different subsystems of an aircraft work together.

- 11. Cost Engineering

- Purpose: Managing and controlling the costs of engineering projects to ensure profitability.
- Tasks: Estimating project costs, analyzing cost-effective alternatives, and optimizing resource allocation.
- Example: Preparing budgets for infrastructure projects and controlling expenses throughout the project lifecycle.

Each of these engineering functions is critical to ensuring an organization's success, whether through innovation, maintaining operational efficiency, or ensuring product quality. Depending on the size and type of organization, engineering roles might overlap or require highly specialized skills.

Product Development

- Product development is the entire process of bringing a new product or service to market. It involves multiple stages, each of which is essential for creating something valuable that meets customer needs and stands out in the marketplace. Key phases of product development include:
- 1. Idea Generation: An idea is a thought, concept or mental image that forms in the mind, often as a response to a question, need or desire. Coming up with new product concepts based on customer needs, market trends, or innovative technologies. This can be done through brainstorming, market research, and customer feedback.
- 2. Idea Screening: Evaluating the feasibility and potential of each idea. The goal is to filter out ideas that may not be viable due to high costs, technical limitations, or low market demand.

- 3. Concept Development and Testing: Refining the product concept and testing it with a small group of target customers. This helps ensure the product idea matches with the market.
- 4. Business Analysis: Assessing the financial aspects of the product, including cost projections, pricing strategy, sales forecasts, and profitability.
- 5. Product Development: Moving from concept to actual product creation. This includes designing, engineering, prototyping, and repeating the product based on testing and feedback.

- 6. Market Testing: Releasing the product to a limited audience to evaluate performance and gather customer feedback. This helps identify any issues or improvements before a full-scale launch.
- 7. Commercialization: Introducing the product to the broader market. This includes finalizing production, launching marketing campaigns, distributing the product, and establishing sales channels.

- 8. Post-Launch : After the launch, the product is monitored for performance, customer satisfaction, and competitive positioning. Companies may make adjustments to improve the product or extend its lifecycle with new features or updates.

Each phase requires close collaboration between various departments such as R&D, marketing, design, engineering, and customer support to ensure that the final product is successful and well-received by the market.

Maintaining IT system

- An IT system (Information Technology system) refers to the hardware, software, networks, and processes that are designed and used to collect, process, store, and distribute information. IT systems are crucial for businesses, organizations, and individuals to manage data and perform essential functions. Here are the key components of an IT system:
- 1. Hardware
- Physical components of an IT system, such as:
- Servers: Machines that store, manage, and process data.
- Computers: Devices used by end-users to access and interact with IT systems.
- Networking Equipment: Routers, switches, and hubs that manage data flow between devices.
- Storage Devices: Hard drives, solid-state drives, and cloud storage solutions.
- Peripherals: Printers, scanners, and other external devices.

- 2. Software
- Programs and applications that run on the hardware, allowing users to perform tasks and manage data:
- Operating Systems: Windows, macOS, Linux, etc.
- Application Software: Word processors, spreadsheets, databases, and enterprise software like ERP (Enterprise Resource Planning), CRM (Customer Relationship Management).
- System Software: Middleware and firmware that help in managing hardware and providing core functionality.

- 3. Network
- The interconnected systems that allow communication and data transfer between devices:
- Local Area Networks (LANs): Networks within a small area, like an office.
- Wide Area Networks (WANs): Networks that cover larger geographical areas, such as between offices or cities.
- Internet and Cloud Services: Connectivity to global networks and cloud-based applications or storage solutions.
- Intranet/Extranet: Private networks within organizations (intranet) or shared between businesses (extranet).

- 4. Data
- The core of any IT system. This includes all forms of information processed or stored by the system, such as:
- Structured Data: Data organized into formats like databases (e.g., SQL).
- Unstructured Data: Text documents, images, and other types of data that don't fit neatly into databases.
- Big Data: Large, complex datasets processed and analyzed for insights.

- 5. Procedures and protocols that define how IT systems are used and managed. This includes:
 - Backup and Recovery: Methods to ensure data is preserved and recoverable in case of failure.
 - Security Protocols: Encryption, firewalls, and intrusion detection systems to protect data.
 - Compliance: Ensuring the IT system meets regulatory requirements (e.g., GDPR, HIPAA).
- 6. People
 - The users and IT professionals who interact with and manage the IT system:
 - End-Users: Employees, customers, and partners who use applications and services.
 - IT Personnel: Administrators, developers, network engineers, and security experts responsible for maintaining the system.

- Support Staff: Help desk and technical support teams who provide assistance to users.
- 7. Security
- An essential aspect of IT systems, involving tools and practices to safeguard data and infrastructure:
- Access Controls: Ensuring that only authorized users can access certain data or systems.
- Encryption: Protecting data in transit or at rest from unauthorized access.
- Firewalls and Antivirus: Protecting the network and individual devices from malicious attacks.
- Incident Response: Processes for detecting, responding to, and mitigating security threats.

- 8. Integration
- How various systems and services interact with each other, ensuring seamless data flow and business operations:
- APIs (Application Programming Interfaces): Enable different software applications to communicate and exchange data.
- Middleware: Software that connects different applications and services, ensuring compatibility and data synchronization.
- In businesses, IT systems are integral to day-to-day operations, supporting functions such as communication, data management, automation, and decision-making. Organizations rely on IT systems for efficiency, scalability, and competitive advantage.

Quality Assurance (QA)

- Quality Assurance (QA) in engineering management involves the systematic process of ensuring that engineering projects and products meet defined quality standards and requirements. It is a proactive and process-oriented approach that focuses on preventing faults and issues throughout the product lifecycle, from design to production to post-launch. In engineering management, QA plays a crucial role in maintaining efficiency, reliability, and customer satisfaction. Here's how QA is integrated into engineering management:
- 1. Establishing Standards and Guidelines
- QA begins with defining clear quality standards, which may be based on industry regulations, customer requirements, or internal policies.
- Engineering managers ensure that these standards are documented and communicated to all teams involved, including design, development, production, and testing.

- 2. Design and Development QA
- QA processes are integrated early in the design and development phases to ensure that potential problems are identified and mitigated before they impact on production.

- 4. Testing and Verification
- One of the core elements of QA in engineering is testing to verify that the product meets all performance and quality requirements.
- Unit Testing: Testing individual components to ensure they function correctly before integration.
- Integration Testing: Ensuring that different subsystems or components work together as expected.
- System Testing: Verifying the entire system's functionality under various conditions and stress tests.
- Acceptance Testing: Testing the final product to ensure it meets customer expectations and project specifications.
- 5. Continuous Monitoring and Feedback
- In QA, continuous monitoring of both the process and product performance is essential for detecting and addressing issues as they arise.

- 6. Supplier Quality Management
- Engineering projects often involve third-party suppliers who provide components or materials. QA processes extend to supplier management to ensure that inputs meet required quality standards.
- Supplier Audits: Regular evaluation of suppliers' processes and outputs to ensure they are in line with quality requirements.
- Supplier Qualification: Assessing and approving suppliers based on their ability to consistently meet quality expectations.
- Incoming Inspection: Testing and verifying materials or components received from suppliers before they are used in production.

- 7. Risk Management
- Quality assurance in engineering management involves proactive risk identification and mitigation strategies to avoid potential failures or faults.
- Risk Assessment: Identifying and analyzing risks related to quality, such as design fault, material faults, or process variations.
- Preventive Actions: Implementing measures to reduce the likelihood of identified risks occurring.
- Corrective Actions: Addressing and resolving issues once they are detected, ensuring that similar problems are avoided in the future.

- 8. Continuous Improvement
- QA in engineering management is an ongoing process that encourages continuous improvement in quality processes, products, and systems.

- 9 Customer-Centric Approach
- QA in engineering management is not just about meeting internal standards but also about ensuring that the final product meets or exceeds customer expectations.
- Customer Feedback and Surveys: Gathering feedback from customers to evaluate the product's performance and satisfaction.
- Warranty and Post-Delivery Support: Offering warranties and after-sales support to resolve any product issues and maintain quality assurance beyond delivery.

- Conclusion
- Quality assurance in engineering management is critical for delivering high-quality products that meet safety, performance, and reliability standards. By incorporating structured QA processes, engineering managers can minimize risks, improve efficiency, reduce costs, and increase customer satisfaction. The continuous monitoring and improvement mindset in QA help ensure that products are consistently refined and stay competitive in the market.

Roles and responsibilities of an engineering manager

- An Engineering Manager is responsible for overseeing the technical and human resource aspects of a development or engineering team. Their role bridges the gap between the technical and managerial territories. Here are their key roles and responsibilities:
- 1. Team Leadership and Development
- Hiring and Onboarding: Recruiting, interviewing, and onboarding new engineers.
- Mentoring and Coaching: Guiding the professional development of team members through regular feedback, performance reviews, and career growth discussions.
- Fostering Team Collaboration: Encouraging collaboration within the team and ensuring effective communication between engineers, designers, product managers, and other stakeholders.

- 2. Technical Oversight
- Architecture and Code Reviews: Ensuring the team follows to best practices in coding, software architecture, and system design.
- Technical Guidance: Providing leadership in solving complex technical challenges, making high-level design decisions, and ensuring quality standards are met.

- Project Planning and Execution: Collaborating with project managers and other stakeholders to define technical requirements and ensure timely delivery of projects.
- 3. Project Management
- Resource Allocation: Assigning team members to tasks based on skills, availability, and project priorities.
- Deadline Management: Managing timelines, ensuring the team is on track to meet deadlines and helping mitigate risks or delays.
- Monitoring Progress: Tracking the progress of the team's work, managing workloads, and adjusting priorities as necessary.

- 4. Collaboration
- Cross-Functional Communication: Acting as the link between engineering teams and other departments (e.g., product management, marketing, sales) to ensure alignment on goals and strategies.
- Reporting: Providing regular updates to senior management on team progress, technical challenges, and resource needs.
- 5. Quality and Process Improvements
- Process Optimization: Implementing and refining engineering processes to improve team productivity, efficiency, and quality of outcomes.
- Ensuring Best Practices: Promoting loyalty to practices, testing protocols, and continuous integration/deployment.

- 6. Budget and Resource Management
- Resource Planning: Managing budgets, including tools, software, and headcount for the engineering team.
- Cost Management: Identifying cost-saving opportunities without compromising quality or delivery timelines.

- 7. Conflict Resolution
- Managing Team Dynamics: Addressing interpersonal conflicts within the team, ensuring a healthy work environment, and resolving issues before they escalate.

Engineering Managers play a key role in blending the technical and strategic components, ensuring that their teams are both motivated and capable of delivering high-quality work.

