SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHAVIDYALAYA
(University established under section 3 of UGC Act 1956)
(Accredited With 'A' Grade by NAAC)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Material on
Principles of Management &
Professional Ethics
VI SEMESTER

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PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS   VI-Semester

OBJECTIVES:

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- ❖ To develop knowledge on the principles of management essential for all kinds of people in all kinds of organizations.
- ❖ To have a clear understanding of the managerial functions like planning, organizing, leading and controlling.
- ❖ To understand global business and diversity.
- ❖ To gain some basic knowledge on international aspect of management.
- ❖ To understand the concepts of computer ethics in work environment.

UNIT- I INTRODUCTION TO MANAGEMENT Definition of Management, process of Management-Planning, Organizing, leading, Controlling Classical Approach-Contribution. and Limitation, Management Science Approach, Skills, Roles and Performance: Types of managers Managerial Skills,- Technical Skill, Analytical Skill Decision Making skill, Human Relation skill, Communication skill. Managerial Roles – Interpersonal Role, Informational Role, Decisional Role.

UNIT – II PLANNING FUNCTION Elements of Planning-Objectives, Action, Resource, Implementation. Managerial Decision Making: Types of Decision, Process of Decision Making, Decision Making-Certainty Condition, Uncertainty Condition, Selecting Alternative. Managing Information System; Need for Decision Support System, MIS and DSS Strategic Planning –Organizational Strategy, Business Portfolio Matrix.

UNIT –III ORGANIZING FUNCTION Organizational Structure- Job Design, Departmentation, Span of Control, Delegation of Authority, Decentralized authority, Chain of Command and Authority, Line and Staff concept Matrix organizational Design

UNIT –IV ENGINEERING ETHICS Senses of 'engineering ethics' – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – kohlberg's theory – Gilligan's theory – consensus and controversy – professions and professionalism – professional ideas and virtues – theories about right action – self-interest – customs and religion – uses of ethical theories

UNIT – V ENGINEER'S RESPONSIBILITY FOR SAFETY Safety and risk – Assessment of safety and risk – Risk benefit analysis – Reducing risk – The Three Mile Island and Chernobyl- case studies

OUTCOMES: At the end of the course the student should be able to:

- ❖ Examine situations and to internalize the need for applying ethics principles, values to tackle with various situations.
- ❖ Develop a responsible attitude towards the use of computer as well as the technology.
- ❖ Able to envision the societal impact on the products / projects they develop in their career.
- ❖ Understanding the code of ethics and standards of computer professionals.
- ❖ Analyze the professional responsibility and empowering access to information in the work place.

TEXT BOOKS

1. Mike Martin & Roland schinzinger "Ethics in engineering" McGraw Hill 2009.
2. Govindarajan M, Natarajan. S.Senthil kumar V.S, "Engineering Ethics", Prentice Hall of India, 2004

REFERENCE BOOKS

1. Charles D.Fleddermamm, "Engineering Ethics", Pearson Hall (2004)
2. Charles E.Haris, Michael S.Protchard & Michael J.Rabins, "Engineering Ethics- concepts and cases", Wadsworth Thompson Learning
3. Jhon R.Boartright, "Ethics and conduct of Business", Pearson Education (2003)
4. Edmund G.See Bauer & Robert L.Bany, "Fundamental of Ethics for Scientists and Engineering", Oxford University

Principles of Management & Professional Ethics

VI Semester

Aim and Objectives:

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UNIT I

INTRODUCTION TO MANAGEMENT

1.1 DEFINITIONS FOR MANAGEMENT

Management has been defined by various authors in various ways. The following are the few quoted definitions −

Definition 1:

By **Peter Drucker** - The basic task of management includes both marketing and innovation. According to him, Management is a multipurpose organ that manages a business and managers, and manages workers and work.

Definition 2:

By **Harold Koontz** - Management is the art of getting things done through and with people in formally organized groups.

Definition 3:

By **George R. Terry** - Management is a distinct process consisting of planning, organizing, actuating and controlling; utilizing in each both science and arts, and followed in order to accomplish pre-determined objective.

Definition 4:

By **Mary Cushing Nile** - Good management, or scientific management, achieves a social objective with the best use of human and material energy and time, and with satisfaction for the participants and the public.

Definition 5:

By **Joseph Massie** - Management is defined as the process by which a cooperative group directs action towards common goals.

Definition 6:

By **Henri Fayol** - Management is to forecast, to plan, to organize, to command, to coordinate and control activities of others.

All these definitions place an emphasis on the attainment of organizational goals or objectives through deployment of the management process - planning, organizing, directing, etc.for the best use of organization's resources.

The principles of management are the means by which a manager actually manages - get things done through others − individually, in groups, or in organizations. The principles of management are the activities that plan, organize, and control the operations of the basic elements of materials, machines, methods, money and markets, providing direction and coordination, and giving leadership to human efforts to achieve the objectives of the enterprise.

1.2 IS MANAGEMENT AN ART OR A SCIENCE?

Like any other discipline such as law, medicine or engineering, managing is an art. Management concepts need to be approached and practiced for its success. Managing is doing things artistically in the light of the realities of a situation. Management is definitely an art but its underlying applications, methods and principles

are a science. It is also opined that management is an art struggling to become a science.

Management as an Art:

The personal ingenious and imaginative power of the manager lends management the approach of an art. This creative power of the manager enriches his performance skill. The art of managing involves the conception of a vision of an orderly created from chaotic parts and the communication and achievement of this vision. Managing can be called art of arts because it organizes and uses human talent, which is the basis of every artistic activity.

Management as a Science:

Management is a body of systematized knowledge accumulated and established with reference to the practice and understanding of general truth concerning management. It is true that the science underlying managing is not as accurate or comprehensive as physical sciences which deal with non-human entities. The involvement of the human angle makes management not only complex but also controversial as pure science. The study of the scientific elements in management methodologies can certainly improve the practice of management.

Management as a Science and Art:

Science urges us to observe and experiment a phenomenon, while art teaches us the application of human skill and imagination to the same. In order to be successful, every manager needs do things effectively and efficiently. This requires a unique combination of both science and art. The art of managing begins where the science of managing stops. As the science of managing is imperfect, the manager must turn to artistic managerial ability to perform a job satisfactorily.

1.3 PROCESS OF PLANNING

The primary challenge faced by organizations and managers today is to solve business problems. The principles of management are guidelines using which managers can tackle business challenges. They have been categorized into the four major functions of planning, organizing, leading, and controlling popularly known as the P-O-L-C framework.

1.3.1 Planning

Fig 1.1 Elements of Management Process

Planning is the first and the most important function of management that involves setting objectives and determining a course of action for achieving those objectives. Planners are the managers who are aware of environmental conditions

facing their organization and are able to effectively analyze and predict future conditions. It also requires that managers should be good decision makers.

Planning means determining what the organization's position and situation should be at some time in the future and deciding how best to bring about that situation. It helps maintain managerial effectiveness by guiding future activities. Planning as a process typically involves the following steps −

- Selection of goals for the organization.
- Establishment of goals for each of the organization's sub-units.
- Establishment of programs for achieving goals in a systematic manner.

Types of Planning:

- Strategic planning involves analyzing competitive opportunities and threats, as well as the strengths and weaknesses of the organization. It also involves determining how to position the organization to compete effectively in their environment.
- Tactical planning is creating the blueprint for the lager strategic plan. These plans are short term and are carried out by middle-level managers.
- Operational planning covers the entire organization's goals and objectives and put into practice the ways and action steps to achieve the strategic plans. They are very short terms usually less than a year.

1.3.2 Organizing

Once a work plan is created, the next phase in management cycle is to organize the people and other resources necessary to carry out the plan. Organizing should also consider the resources and physical facilities available, in order to maximize returns with minimum expenditure. Organizing involves the following steps −

- Creating the organizational structure: The framework of the organization is created within which effort is coordinated allocating human resources to ensure the accomplishment of objectives.
- Making organizational design decisions − Decisions are made about the structure of an organization.
- Making job design decisions − Roles and responsibilities of individual jobs, and the process of carrying out the duties is defined.

Organizing at the level of a particular job involves how best to design individual jobs so as to most effectively utilize human resources.

1.3.3 Leading

Organizations develop complex structures with an increasing need for co-ordination and control. To cope and manage such situations, leadership is necessary to influence people to cooperate towards a common goal and create a situation for collective response. Leading entails directing, influencing, and motivating employees to perform essential tasks. It also involves the social and informal sources of influence to inspire others. Effective managers lead subordinates through motivation to progressively attain organizational objectives. Personality research and study of job attitudes in Behavioral Science provides important insight on the need for coordination and control.

1.3.4 Controlling

Managers engage in the managerial function of controlling to some degree. Two traditional control techniques are budget and performance audits. An audit involves a

physical examination and verification of the organization's records and supporting documents. A budget audit provides information about where the organization is with respect to procedures followed for financial planning and control, whereas a performance audit might try to determine whether the figures reported are a reflection of actual performance.

Controlling is not just limited to organization's financial state, but also spans across areas like operations, compliance with company policies and other regulatory policies, including many other activities within the organization. Thus management functions most effectively cover the broad scope of a manager's duties and responsibilities.

1.4 CLASSICAL APPROACH
1.4.1 Introduction

Classical management theory is a branch of management theory which evolved around the 19th   century. It was developed during the industrial revolution when problems related to factory systems began, to recognize the role that management plays in an organization particularly focusing on the efficiency of the work process. Classical approach of management professes the body of management thought based on the belief that employees have only economical and physical needs and that the social needs & needs for job satisfaction either does not exist or are unimportant.

1.4.2 Constituent Theories of Classical Approach

Scientific Management Theory: This theory was propounded by Frederick Winslow Taylor. Taylor believed that by analyzing work in a scientific manner, it was possible to find the one best way to perform a task. He felt that by organizing work in the most efficient way, the organization's productivity would be increased, allowing it to reward employees with additional remuneration, which Taylor argued was employee's only motivation.

Bureaucratic Management Theory: This was developed by a German Sociologist and political economist Max Weber (1864-1920). According to him, bureaucracy is the most efficient form of organization. The organization has a well-defined line of authority. It has clear rules and regulations which are strictly followed.

Administrative Management Theory: The first expert of Administrative Management Theory was Henri Fayol (1841-1925). Fayol is called the "Father of Modern Management". According to the Administrative Management Theory / School, management is the process of getting things done through people. Here importance is given only to groups and not to any individual.

1.4.3 Features of Classical Approach

- Management is viewed as a systematic process of interrelated functions.
- Principles of management are used as a guideline for the executives.
- Functions , Principles and skills of management are universal.
- Formal education and training is needed for the development of the required skills.
- Emphasis is placed on the economic efficiency.
- People are motivated by economic gains and other incentives.
- Classical theory pillar mainly stands on three pillars :Bureaucracy, Scientific management and Administration.

1.4.4 Strengths of Classical Approach

Hierarchical Structure: One of the advantages of the classical management structure is a clear organizational hierarchy with three distinct management levels. Each management group has its own objectives and responsibilities.

Division of Labour: One of the advantages of classical management approach is the division of labor. Projects are broken down into smaller tasks that are easy to complete. Employees' responsibilities and expectations are clearly defined. This approach allows workers to narrow their field of expertise and to specialize in one area.

Monetary Incentive: According to classical management theory, employees should be motivated by monetary rewards. In other words, they will work harder and become more productive if they have an incentive to look forward to. This gives management easier control over the workforce.

Autocratic Leadership: The autocratic leadership approach is the central part of classical management theory. It states that an organization should have a single leader to make decisions, to organize and direct the employees. All decisions are made at the top level and communicated down.

1.4.5 Weakness of Classical Approach

Untested assumptions: Many of the assumptions made by classical writers were based not on scientific tests but on value judgments that expressed what they believed to be proper life-styles, moral codes, and attitudes toward success.

Failure to consider the informal organization: In their stress on formal relationships in the organization, classical approaches tend to ignore informal relations as characterized by social interchange among workers, the emergence of group leaders apart from those specified by the formal organization, and so forth.

Human machinery: Classical theories leave the impression that the organization is a machine and that workers are simply parts to be fitted into the machine to make it run efficiently. Thus, many of the principles are concerned first with making the organization efficient, with the assumption that workers will conform to the work setting if the financial incentives are agreeable.

Static conditions: Organizations are influenced by external conditions that often fluctuate over time, yet classical management, theory presents an image of an organization that is not shaped by external influences.

1.5 MANAGEMENT SCIENCE APPROACH

Management Science Approach is a scientific approach to problem solving and decision making. It encompass a logical approach to decision making. It can be used in any organization to solve different types of problems. Problem solving is defined as the process of identifying the difference between actual and desired state affairs.

The problem solving process –
- Identify and define the problem
- Determine the set of alternative solutions
- Determine the criterion used to evaluate the alternatives
- Evaluate the alternatives
- Choose an alternative
- Implement the selected alternative and evaluate the result

Decision Making is the term generally associated with the first five steps of the problem solving process. The first step of decision making is to identify and defines the problem. Decision making ends with the choosing of the an alternative, which is the act of making the decision
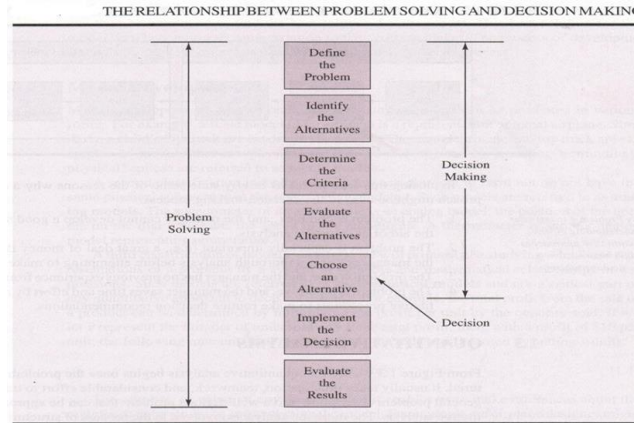

Fig 2 Problem Solving Vs Decision Making

1.5.1 Struturing and Analyzing the Problem

The given problem can be structured and analyzed as per the following steps -

- Model Development
- Data Preparation
- Model Solution
- Implementation and Report
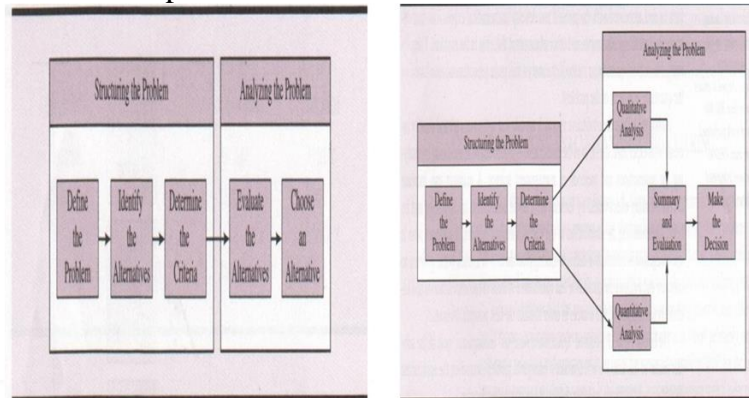
Fig 1.3 Structuring and Analyzing the Problem

Model Development:

Models are representation of real object or situation that can be presented in various forms. The models can be classified into iconic models, analog models and mathematical models.

- Iconic models are physical replicas of real objects. Eg: The model airplane and toy truck
- Analog models are physical in form but do not have the same physical appearance as the object being modeled. E.g. The speedometer represent the speed of automobile

- Mathematical Models are representations of problem by a system of symbol and mathematical relationship or expression. E.g. P = 10x

Data Preparation:
- The preparation of the data required by the model
- Data refer to the values of uncontrollable input to models
- If data required are few, the analysis will combine model development and data preparation into one step by inserted as the equation

Model Solution:
- Model Solution attempt to identify the values of the decision variables that provide the best output as the optimal solution for the model
- One procedure that might be used in the model solution step involves a trial-and- error approach

Implementation and Report:
- Making concluding remarks based on model solution
- Preparing the managerial report based on the conclusion
- The report is one of the inputs for the manager considering before making a final decision

1.5.2 Management Science Techniques
The following are some of the management science techniques.
- Linear Programming
- Transportation and Assignment Models
- Project Scheduling
- Inventory Models
- Queuing Models
- Decision Analysis
- Goal Programming
- Analytic Hierarchy Process
- Simulation
- Forecasting
- Markov Process Models
- Dynamic Programming

1.5.3 Management Science Software
The following is the list of softwares used for management science approach.
- Linear Programming
- Transportation
- Assignment
- Integer Linear Programming
- Shortest Route
- Minimal Spanning Tree
- Inventory
- Waiting Lines
- Decision Analysis
- Forecasting
- Markov Processes

1.6 TYPES OF MANAGERS

Every organization has 'Managers' who are entrusted with the responsibility of guiding and directing the organization to achieve its goals. Managers administer and coordinate resources effectively and to channelize their energy towards successful accomplishment of the goals of the organization. Managers are required in all the activities of organizations. Their expertise is vital across departments throughout the organization.

Larger organizations are particularly complex due to their size, process, people and nature of business. However, organizations need to be encompassing every employee and their talent, directing them towards achieving the set of business goals. This is an extremely challenging endeavor, and requires highly effective managers having evolved people management and communication skills.
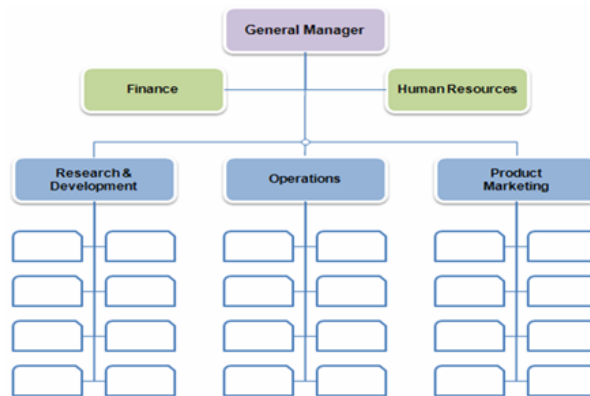

Fig 1.4 Functional Organizational Structure

1.6.1 The Top Management

The top level executives direct the organization to achieve its objectives and are instrumental in creating the vision and mission of the organization. They are the strategic think-tank of the organization.

1.6.2 Senior Management

The General Manager is responsible for all aspects of a company. He is accountable for managing the Profit & Loss statement of the company. General managers usually report to the company board or top executives and take directions from them to direct the business. The Functional Manager is responsible for a single organizational unit or department within a company or organization. He in turn is assisted by a Supervisor or groups of managers within his unit/department. He is responsible for the department's profitability and success.

1.6.3 Line and Staff Managers

Line Managers are directly responsible for managing a single employee or a group of employees. They are also directly accountable for the service or product line of the company. For example, a line manager at Toyota is responsible for the manufacturing, stocking, marketing, and profitability of the Corolla product line. Staff Managers often oversee other employees or subordinates in an organization and generally head revenue consuming or support departments to provide the line managers with information and advice.

1.6.4 Project Managers

Every organization has multiple projects running simultaneously through its life cycle. A project manager is primarily accountable for leading a project from its inception to completion. He plans and organizes the resources required to complete the project. He will also define the project goals and objectives and decide how and at what intervals the project deliverables will be completed
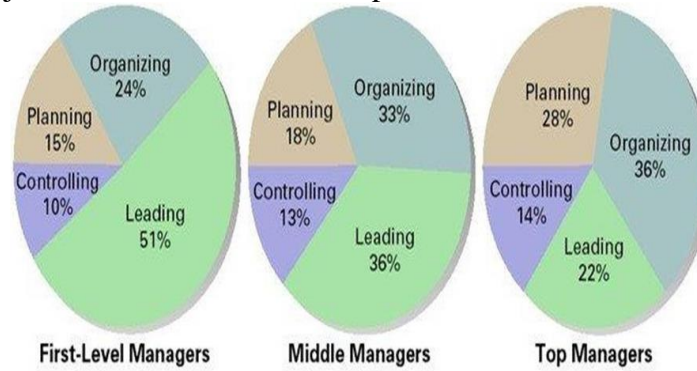

Fig 1.5 Comparison of Managers

1.7 SKILLS OF A MANAGER

Henri Fayol, a famous management theorist also called as the Father of Modern Management, identified three basic managerial skills - technical skill, human skill and conceptual skill.
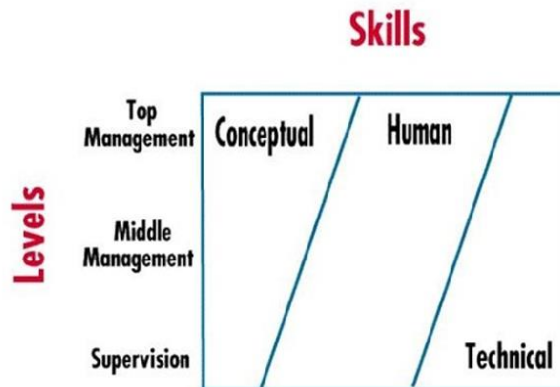

Fig 1.6 Skill Distribution at Various Levels

1.7.1 Technical Skills

Accountants, engineers, surgeons all have their specialized technical skills necessary for their respective professions. Managers at the lower and middle levels, need technical skills for effective task performance. Technical skills are important especially for first line managers, who spend much of their time training subordinates and supervising their work-related problems.

1.7.2 Human Skills

Ability to work with, understand, and motivate other people as individuals or in groups. According to Management theorist Mintzberg, the top and middle managers spend their time: 59 percent in meetings, 6 percent on the phone, and 3 percent on tours. Ability to work with others and get co-operation from people in the work group. For example, knowing what to do and being able to communicate ideas and beliefs to others and understanding what thoughts others are trying to convey to the manager.

1.7.3 Conceptual Skills

Ability to visualize the enterprise as a whole, to envision all the functions involved in a given situation to understand how its parts depend on one another, and anticipate how a change in any of its parts will affect the whole. Creativity, broad knowledge and ability to conceive abstract ideas. For example, the managing director of a telecom company visualizes the importance of better service for its clients which helps attract a vast number of clients and an unexpected increase in its subscriber base and profits.

1.7.4 Other Managerial Skills

Besides the skills discussed above, there are two other skills that a manager should possess, namely diagnostic skills and analytical skills.

Diagnostic Skills:

Diagnose a problem in the organization by studying its symptoms. For example, a particular division may be suffering from high turnover. With the help of diagnostic skill, the manager may find out that the division's supervisor has poor human skill in dealing with employees. This problem may be solved by transferring or training the supervisor.

Analytical Skills:

Ability to identify the vital elements in a given situation, evaluate their interdependence, and decide which ones should receive the most attention. This skill enables the manager to determine possible strategies and to select the most appropriate one for the situation. For example, when adding a new product to the existing product line, a manager may analyze the advantages and risks and make a recommendation to the board of directors, who make the final decision.

Communication Skills:

- Communication skills are very important for all managers and leaders.
- Good communication skills allow managers and leaders to perform their roles more effectively.
- They must communicate effectively to the team, to their suppliers, to their customers and financiers.
- It is important that leaders and managers are good communicators.
- Communication skills for managers and leaders are different from communication skills for the average person in the street.

1.8 ROLES OF A MANAGER

Every organization has three primary interpersonal roles concerned with interpersonal relationships. The manager in the figurehead role represents the organization in all matters of formality. The top-level manager represents the company legally to the outside world that the organization interacts with. In the supervisory role, the manager represents his team to the higher management. He acts as a liaison between the higher management and his team. He also maintains contact with his peers outside the organization.

Professor Henry Mintzberg, a great management researcher, after studying managers for several weeks concluded that, to meet the many demands of performing their functions, managers assume multiple roles. He identified the following ten roles

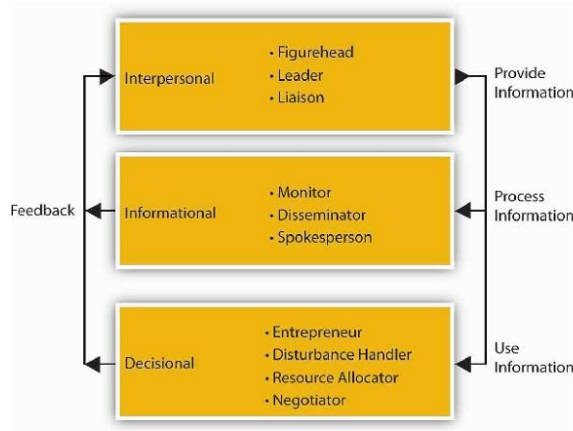common to the work of all managers. These roles have been split into three groups as illustrated in Figure 1.7.

Fig 1.7 Ten Roles of a Manager

1.8.1 Interpersonal Role

- Figurehead − Has social, ceremonial and legal responsibilities.
- Leader − Provides leadership and direction.
- Liaison − Networks and communicates with internal and external contacts.

1.8.2 Informational Role

- Monitor − Seeks out information related to your organization and industry, and monitors internal teams in terms of both their productivity and well-being.
- Disseminator − Communicates potentially useful information internally.
- Spokesperson − Represents and speaks for the organization and transmits information about the organization and its goals to the people outside it.

1.8.3 Decisional Role

- Entrepreneur − Creates and controls change within the organization - solving problems, generating new ideas, and implementing them.
- Disturbance Handler − Resolves and manages unexpected roadblocks.
- Resource Allocator − Allocates funds, assigning staff and other organizational resources.
- Negotiator − Involved in direct important negotiations within the team, department, or organization.

1.9 MODEL QUESTIONS
Part – A
1. Define Management.
2. List the classification of Managerial roles.
3. Distinguish between Management and Administration.
4. What is the basic role of Managers?
5. List the major principles of Management as guess by Henri Fayol.
6. Mention the various inputs required for any industry.
7. List the skills needed by a Manager.
8. Define Communication skill.
9. What is technical skill?
10. Compare Entrepreneur and Manager.
11. Identify whether Management is Science or Art?
12. Classify the types of Managers.
13. Discuss the concept of Scientific Management.
14. Define organization.
15. Compare effectiveness and efficiency.
16. How is environment related to management?
17. Compare time and motion study.

Part –B
1. List the skills needed by a Manager. Explain the relationship between skills and levels of Managers. Illustrate with an example.
2. List the five functions of Managers and explain them.
3. Discuss the various functions of management and various management approaches.
4. Explain the various skills of Managers in detail.
5. With a neat diagram, explain the systems approach to the management process.
6. List and explain the ten managerial roles.

Unit II

PLANNING FUNCTION

2.1 INTRODUCTION TO PLANNING
2.1.1 What is Planning?
Planning is the most basic of all managerial functions which involves establishing goals, setting out objectives and defining the methods by which goals and objectives are to be attained. It is a rational approach to achieving pre-selected objectives. Planning involves selecting missions and objectives and the actions to achieve them. An important aspect of planning is decision making - choosing the right alternatives for the future course of action.

2.1.2 Need for Planning
Organizations have to plan for long-range and short-range future direction. By forecasting and predicting the market and socio-political-economic trends, managers can plan to determine the future of the company. Planning involves determining various types and volumes of physical and other resources to be acquired, allocating these resources in an efficient manner and to make arrangement for systematic conversion of these resources into useful outputs.

Since plans are made to attain goals or objectives, every plan should lead to the achievement of the organization's purpose and objectives. An organized enterprise exists to accomplish group objectives through willing and purposeful co-operation. Planning bridges the gap between where the organization stands currently and wishes to be in future. In the absence of planning, events are left to chance.

2.1.3 Importance of Planning
Planning not only brings stability and certainty to business, it also brings a unified sense of direction and purpose for the achievement of certain well-defined objectives. The basic reasons supporting systematic planning by managers are −

Sense of Direction: It brings together all resources towards achieving common goals. Without plans organizations will respond to everyday events in an ad-hoc manner without considering long-term possibilities.

Resource Paucity: Managements are confronted with the task of optimizing outputs with limited human, material, and financial resources through intelligent planning; otherwise inefficiencies would lead to higher prices and severe shortages.

Uncertainty: Organizations face micro and macro-economic uncertainty in the course of accomplishing their tasks. Planning helps managers anticipate such changes and meet these challenges.

2.1.4 Reasons for formulating Plans
The following are the reasons for formulating plans -
- To focus organizational activity on a set of consciously created objectives.
- To provide a systematic guide for future activities.
- To increase organizational outcome through efficient operation.
- To encourage systematic thinking.
- To facilitate effective delegation of authority, removes communication gaps, and thereby raises overall efficiency.

2.1.5 Limitations of Planning

The following are the limitations of Planning –

- Lack of accurate information
- Time and cost
- Resistance to change
- Lock of ability to plans
- False sense of security
- Environmental constraints

2.2 TYPES OF PLANS

Plans commit the various resources in an organization to specific outcomes for the fulfillment of future goals. Different types of plans are adopted by management to monitor and control organizational activities.

Fig 2.1 Types of Plans

2.2.1 Strategic Plans

Strategic plans define framework of the organization's vision and how the organization intends to make its vision a reality. It is the determination of the long-term objectives of an enterprise, action plan and the resources to be mobilized to achieve these goals. Since it is planning the direction of the company's progress, it is done by top management of an organization. It focuses on planning for the coming years to take the organization to where it intends to be. The strategic plan must be forward looking, effective and flexible, with a focus on accommodating future growth.

2.2.2 Tactical Plans

Tactical plans describe the tactics that the managers plan to adopt to achieve the objectives set in the strategic plan. Tactical plans span a short time frame (less than 3 years) and are usually developed by middle level managers. It details specific action plans to implement the strategic plan by units within each division. Tactical plans entail detailing resource and work allocation among the subunits within each division.

2.2.3 Operational Plans

Operational plans are short-term (less than a year) plans developed to create specific action that support the strategic and tactical plans. They are developed by the manager to fulfill his or her job responsibilities. They are developed by supervisors, team leaders, and facilitators to support tactical plans. They govern the day-to-day operations of an organization.

Operational plans can be −

- *Standing plans:* Drawn to cover issues that managers face repeatedly, e.g. policies, procedures, rules.
- *Ongoing plans*: Prepared for single or exceptional situations or problems and are normally discarded or replaced after one use, e.g. programs, projects, and budgets.

2.3 ELEMENTS OF PLANNING

Planning is the fundamental process in management which moves gradually and a step-by-step approach is adopted. It involves the determination of objectives and outlines the future actions needed to achieve these objectives.

Fig 2.2 Elements of Planning

2.3.1 Establishing Objectives and Goals

The first step of the management planning process is to identify goals specific to the organization and also for each department unit. A comprehensive planning effort requires that managers in each department be involved in the planning process. At this stage, the planning process should include a detailed overview of each goal, including the reason for its selection and the anticipated outcomes of goal-related projects. The objectives thus established govern the framework for every major department, which in turn, control the objectives of subordinate departments and so on down the line.

2.3.2 Determining Alternatives

The next step is to find out alternatives that will guide the fulfillment of the objectives established. At this stage, managers need to plan on how to move from their current position towards their decided future position. Managers may find many alternatives dropping the less desirable ones and narrowing on the few desired alternatives is what will help in identifying the best fit solution. The manager can take the help of quantitative techniques, research, experimentation, and experience to determine various alternatives.

2.3.3 Evaluating and Choosing Alternatives

Once alternatives have been identified, each alternative has to be analyzed and evaluated in the light of its strength and weakness and its fitment in achieving the organizational goals. While evaluating alternatives, managers should consider facts like the costs involved, how resource intensive it is, the time frame for completion, the gestation period, return on investment, etc. Major challenges of effective evaluation can be uncertainty about the future and risk. Various intangible factors like market changes, socio-economic-political factors, etc. also have a bearing. At this stage, managers can

use operations research, and mathematical as well as computing techniques to predict and analyze alternatives.

2.3.4 Creating Assignments and Timelines

At this stage, resource allocation and the line of authority and responsibility also needs to be established. The manager should consider the abilities of staff members and allocate the best fit resource for the job. Also the timelines for completion should be realistic and fair. This step in the planning process is important as it brings coordination in the activities of different departments. The timings and sequence of operations must be communicated to the concerned departments, managers and staff for implementation of the plan.

2.3.5 Formulating Derivative Plans

Derivative plans are sub-sections of the operating plan. The division of overall plan into derivative plans is necessary for effective execution. Derivative plans are essentially required to support the basic plan and explain the many details involved in reaching a broad major plan.

2.3.6 Budgeting

Once the plans are finalized and set, the final step is to convert them into quantifiable parameters through budgeting. Budgets are most commonly expressed in terms of money, but also expressed as hours worked, as units sold, or in any other measurable unit. An enterprise has overall budgets representing the sum total of income and expenses, with consequent profit or surplus. Each department of the enterprise or organization can have its own budget, commonly of expenses and capital expenditures, which make up the overall budget. A well planned budgeting exercise can become a standard for measuring the progress and effectiveness of the planning process.

2.4 INTRODUCTION TO DECISION MAKING

Decision making is an integral part of every aspect of life. This also applies to organizations. It is one of the key factors that pave the way for its success or failure. Every manager is required to execute decisions at various levels of the management cycle beginning from planning to control. It is the effectiveness and quality of those decisions that determine how successful a manager is. Without decision making, different managerial functions such as planning, organizing, directing, controlling, and staffing cannot be conducted. Decision making is a cumulative and consultative process, and should support organizational growth.

The main function of every management is making the right decisions and seeing them through to their logical end through execution. Every management decision also affects employee morale and performance, ultimately influencing the overall business performance. The importance of decision making in management is immense, as the business policy and strategies adopted ultimately affects the company's output and performance.

2.4.1 Statement of Decision Making

Decision making is the coherent and rational process of identifying a set of feasible alternatives and choosing a course of action from them.

2.4.2 Factors Related to Decision Making

Decisions taken in an organization are usually related to-
- Goals and Objectives of the Organization

- Organizational Structure
- Organizational Design
- Budgets
- Time Period
- Staff – Wages, Salaries, Working Hours, Promotion etc
- Marketing – Product, Price, Place, Promotion
- Research and Design

2.4.3 Types of Decision Making

Decision making and problem solving is a continuous process of analyzing and considering various alternatives in various situations, choosing the most appropriate course of action and following them up with the necessary actions.

There are two basic types of decisions −
- Programmed Decisions
- Non-programmed Decisions

Programmed decisions: They are made using standard operating procedures or other well-defined methods. They are situations that are routine and occur frequently. Organizations come up with specific ways to handle them. Programmed decisions are effective for day-to-day issues such as requests for leave or permissions by employees. Once the decision is taken, the program specifies procedures to be followed when similar situation arises. Creating such programmed routines lead to the formulation of rules, procedures and policies, which becomes a standard in the organization.

Non-programmed decisions: They are unique and one-shot decisions. They are not as structured as programmed decisions and are usually tackled through judgment and creativity. They are innovative in essence, as newly created or unexpected problems are settled through unconventional and novel solutions.

Table 2.1 Comparison of Programmed Decisions and Non-programmed Decisions

S. No	Programmed Decisions	Non-programmed Decisions
1	Concerned with Routine problems	Concerned with Unique problems
2	Repetitive in Nature	Non-repetitive in Nature
3	Strucutred	unstrucutred
4	Simple and small impact	Complex and long time impact
5	Information readily available	Information readily not available
6	Consumes less time and efforts	Demands time and discretion
7	Lower Executives	Top Management

2,4,4 Other Types of Decisions

- *Routine Decisions:* Decisions made during the normal course of a business that are repetitive in nature and require small investments.

- *Formal Decisions:* Decisions taken by a member of an Organization using formal authority which directly affect the organization.
- *Group Decisions:* Decisions taken by a committee for a specific purpose to make an important decision for the organization.
- *Rational Decisions*: Decisions taken after careful and systematic analysis of a problem and evaluation of several alternatives based on logical facts.
- *Irrational Decisions*: Decisions taken based on intuition or experience of the decision maker.

2.5 PROCESS OF DECISION MAKING

The decision-making process involves the following steps −
- Define the problem
- Identify limiting factors
- Develop potential alternatives
- Analyze and select the best alternatives
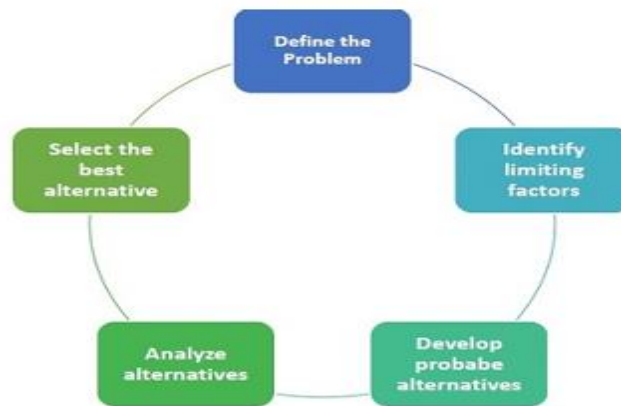- Implement the decision

Fig 2.3 Process of Decision Making

2.5.1 Define the Problem

The first step in the process of decision making is the recognition or identification of the problem, and recognizing that a decision needs to be taken. It is important to accurately define the problem. Managers can do this by identifying the problem separately from its symptoms. Studying the symptoms helps getting closer to the root cause of the problem.

2.5.2 Identify Limiting Factors

In order to choose the best alternative and make a decision every manager needs to have the ideal resources − information, time, personnel, equipment, and supplies. But this is an ideal situation and may not always be possible. A limiting factor is something that stands in the way of accomplishing a desired objective.

2.5.3 Develop Potential Alternatives

Recognizing the limiting factor in a given situation makes it possible to narrow down the search for alternatives and make the best decision possible with the information, resources, and time available. Some methods for developing alternatives are −

- **Brainstorming**, where a group works together to generate ideas and alternative solutions.
- **Nominal group technique** is a method that involves the use of a highly structured meeting, complete with an agenda, and restricts discussion or interpersonal communication during the decision-making process.
- **Delphi technique** where the participants do not meet, but a group leader uses written questionnaires to conduct the decision making.

2.5.4 Analyze the Alternatives

This is an important stage in the decision-making process and perhaps the toughest. Managers must identify the merits and demerits of each alternative and weigh them in light of various situations before making a final decision. Evaluating the alternatives can be done in numerous ways. Here are a few possibilities −

- Qualitative and quantitative measurements
- Perform a cost-effectiveness analysis for each alternative
- Marginal analysis

2.5.5 Selecting Alternatives

Once the alternatives are analyzed and evaluated, the manager has to choose the best one. The manager needs to choose the alternative that gives the most advantage while meeting all the required criteria. Sometimes the choice is simple with obvious benefits, at times the optimal solution is a combination of several alternatives. At times when the best alternative may not be obvious, the manager uses probability estimates, research and analysis aided by his experience and judgment.

2.6 FACTORS AFFECTING DECISION MAKING

Decisions are typically made under one of three conditions −

- Certainty
- Risk
- Uncertainty

These conditions are based on the amount of knowledge the decision maker has regarding the final outcome of the decision. The manager's decision depends on a number of factors, like the manager's knowledge, experience, understanding and intuition.

2.6.1 Certainty

Decisions are made under conditions of certainty when the manager has enough information to know the outcome of the decision before it is made. The manager knows the available alternatives as well as the conditions and consequences of those actions. There is little ambiguity and hence relatively low possibility of making a bad decision.

2.6.2 Risk

Most managerial decisions are made under conditions of risk. Decisions are taken in risk when the manager has some information leading to the decision but does not know everything and is unsure or unaware of the consequences. Under conditions of risk, the manager may find it helpful to use probability estimates. This is where the manager's experience and/or intelligence is of great help.

2.6.3 Uncertainty

Decisions are made under uncertainty when the probabilities of the results are unknown. There is no awareness of all the alternatives and also the outcomes, even for

the known alternatives. Under such conditions managers need to make certain assumptions about the situation in order to provide a reasonable framework for decision making. Intuition, judgment, and experience always play a major role in the decision making process under conditions of uncertainty.

2.7 MANAGEMENT INFORMATION SYSTEM (MIS)

Management Information System is an implementation of the organizational systems and procedures for managers. To a programmer it is nothing but file structures and file processing. However, it involves much more complexity. The three components of MIS provide a more complete and focused definition, where **System** suggests integration and holistic view, **Information** stands for processed data, and **Management** is the ultimate user, the decision makers.

Management Information System or 'MIS' is a planned system of collecting, storing, and disseminating data in the form of information needed to carry out the functions of management.
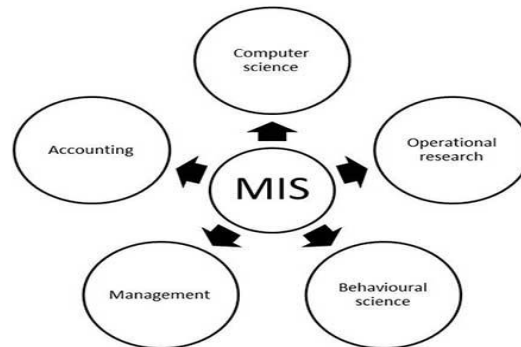

Fig 2.4 Nature and Scope of MIS

2.7.1 Components of MIS

- *Management:* Management covers the planning, control, and administration of the operations of a concern. The top management handles planning; the middle management concentrates on controlling; and the lower management is concerned with actual administration.
- *Information:* Information means the processed data that helps management in planning, controlling and operations. Data means all the facts arising out of the operations of the concern. Data is processed and presented to the management in the form of MIS report.
- *System:* Data is processed into information with the help of a system. A system is made up of inputs, processing, output and feedback or control.

2.7.2 Objectives of MIS

The following are the objectives of MIS -

- Capturing Data: Capturing operational information that will contribute in decision making from various internal and external sources of organization.
- Processing Data: The captured data is processed into information needed for planning, organizing, coordinating, directing and controlling functionalities at strategic, tactical and operational level.
- Information Storage: Information or processed data need to be stored for future use.

- Information Retrieval: The system should be able to retrieve this information from the storage when required by various users.
- Information Propagation: Information or the finished product of the MIS should be circulated to its users periodically using the organizational network.

2.7.3 Characteristics of MIS

The following are the characteristics of MIS -

- Based on a long-term planning.
- It should provide a holistic view of the dynamics and the structure of the organization.
- It should work as a complete and comprehensive system covering all interconnecting sub-systems within the organization.
- It should be planned in a top-down way to provide clear direction at the development stage of the MIS.
- It should be based on need of strategic, operational and tactical information of managers of an organization.
- It should also take care of exceptional situations by reporting such situations.
- It should be able to make forecasts and estimates, and generate advanced information, thus providing a competitive advantage.
- It should create linkage between all sub-systems within the organization, so that the decision makers can take the right decision based on an integrated view.
- It should allow easy flow of information through various sub-systems avoiding redundancy and duplicity of data.
- It should simplify the operations with as much practicability as possible.

2.7.4 Characteristics of Computerized MIS

The following are the characteristics of Computerized MIS –

- It should be able to process data accurately and with high speed using various techniques like operations research, simulation etc.
- It should be able to collect, organize, manipulate, and update large amount of raw data of both related and unrelated nature.
- It should provide real time information on ongoing events without any delay.
- It should support various output formats and follow latest rules and regulations in practice.
- It should provide organized and relevant information for all levels of management.
- It should aim at extreme flexibility in data storage and retrieval.

2.8 DECISION SUPPORT SYSTEMS (DSS)

Decision support systems (DSS) are interactive software-based systems intended to help managers in decision-making by accessing large volumes of information generated from various information systems such as office automation system, transaction processing system, etc. DSS uses the summary information, exceptions, patterns, and trends using the analytical models.

A decision support system helps in decision-making but does not necessarily give a decision itself. The decision makers compile useful information from raw data,

documents, personal knowledge, and business models to solve problems and make decisions.
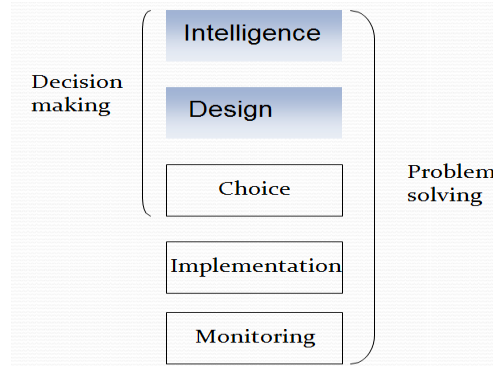

Fig 2.5 Decision Making as a Component of Problem Solving

2.8.1 Types of Decisions with DSS

There are two types of decisions - programmed and non-programmed decisions.

- Programmed decisions are basically automated processes, general routine work where these decisions have been taken several times. For example, selecting a reorder level for inventories, is a programmed decision.
- Non-programmed decisions occur in unusual and non-addressed situations. For example, investing in a new technology is a non-programmed decision. Decision support systems generally involve non-programmed decisions. Therefore, there will be no exact report, content, or format for these systems. Reports are generated on the fly.

2.8.2 Attributes of DSS

The following are the attributes of DSS-

- Adaptability and flexibility
- High level of Interactivity
- Ease of use
- Efficiency and effectiveness
- Complete control by decision-makers
- Ease of development
- Extendibility
- Support for modeling and analysis
- Support for data access
- Standalone, integrated, and Web-based

2.8.3 Characteristics of DSS

The following are the characteristics of DSS-

- Support for decision-makers in semi-structured and unstructured problems.
- Support for managers at various managerial levels, ranging from top executive to line managers.
- Support for individuals and groups.
- Support for interdependent or sequential decisions.
- Support for intelligence, design, choice, and implementation.
- Support for variety of decision processes and styles.

- Adaptive over time.

2.8.4 Components of DSS

The following are the three components of DSS-

- *Database Management System*: To solve a problem the necessary data may come from internal or external database. In an organization, internal data generated by a system such as TPS and MIS. External data come from a variety of sources such as newspapers, online data services etc.
- *Model Management System*: It stores and accesses models that managers use to make decisions. Such models are used for designing manufacturing facility, analyzing the financial health of an organization, forecasting demand of a product etc.
- *Support Tools*: Support tools like online help; pulls down menus, user interfaces, error correction mechanism, facilitates the user interactions with the system

2.8.5 Classification of DSS

- Text Oriented DSS: It contains textually represented information that could have a bearing on decision.
- Database Oriented DSS: Database plays a major role here; it contains organized and highly structured data.
- Spreadsheet Oriented DSS: It contains information in spread sheets that allows create, view, modify procedural knowledge and instructs the system to execute self-contained instructions.
- Solver Oriented DSS: It is based on a solver, which is an algorithm written for performing certain calculations and particular program type.
- Rules Oriented DSS: It follows certain procedures adopted as rules.
- Compound DSS: It is built by using two or more of the five structures explained above.

2.8.6 Types of DSS

The following are the types of DSS-

- Status Inquiry System: It helps in taking operational, management level, or middle level management decisions.
- Data Analysis System: It needs comparative analysis and makes use of formula or an algorithm, for example cash flow analysis, inventory analysis etc.
- Information Analysis System: In this system data is analyzed and the information report is generated.
- Accounting System: It keeps track of accounting and finance related information, for example, final account, accounts receivables etc.
- Model Based System: Simulation models are used infrequently and creates general guidelines for operation or management.

2.9 STRATEGIC PLANNING

Strategic planning is the tool which clearly identify goals and objectives of an organization as well as it also assess the internal and external situation required to formulate and implement the strategy.

1.9.1 Meaning of Strategic Planning

An effective plan is always required to accomplish anything. If any one doing preparation for exam, or running a business, he/she must need a strategic plan. Today business world become much competitive and the olden days of budget oriented planning or forecast based planning gone away. The strategic planning is required and compulsory for the survival of a large corporation. This also helps the organization to evaluate the progress of the strategy and make necessary adjustments to for the purpose of staying at the track. It is because of strategic planning that business management determine where to spend time, human capital, and money resources. The following are the steps for strategic planning -

- Vision, Mission & Objectives
- Situation Analysis or Environmental Scanning
- Strategy Formulation
- Strategy Implementation
- Strategy Evolution & Control
- Vision, Mission & Objectives

Fig 2.6 Strategy Planning Model

2.9.2 Vision, Mission and Objectives

Vision statement shows "what an organization wants to achieve in future? A mission statement shows the basic purpose of an organization and communicates the essence of a company. A mission statement includes following:

- **Purpose:** why a particular organization exists, and what it seeks to accomplish
- **Business:** the main methods, products or activities by which the organization tries to achieve purpose
- **Values:** this refers to those beliefs and principles which guides an organization's management as well as its employees as they pursue the organization's purpose

After the development of vision and mission statements, then companies need to define goals and objectives. Goals may be financial like sales or producing new products and innovation etc.

2.9.3 Situation Analysis

There are two type of situation analysis: - Internal analysis, External analysis. In internals analysis companies needs to identify the strengths and weakness (SWOT Analysis) and in external analysis companies should identify the threats and

opportunities (PEST Analysis). PEST Analysis and SWOT Analysis provide a platform for conducting situation analysis or environmental scanning. By the help of situation analysis and quality information an organization can make effective and achievable decisions. Environmental scanning also helps in listing of critical and most important issues which demand a specific response from the organization.

2.9.4 Strategy Formulation

After development of organization's mission and objectives and situation analysis, it is time to figure out or formulate strategies. Companies may formulate effective strategies by the help of group discussion, formal decision-making techniques and by marketers and management meetings. Strategies provide a frame structure for action stage.

2.9.5 Strategy Implementation

After formulating strategies next step is to practically implement those strategies. For the purpose of strategy implementation a company needs to organize its resources and motivate staff to achieve its objectives. If there are different people or department who formulate the strategies and those who are implementing these, then care must be taken to communicate the strategies. If care not taken then there may be chances of strategies failures because of misunderstanding by lower level staff.

2.9.6 Strategy Evaluation and Control

This is the last step of strategic planning process. In this step management and marketer required to monitor the strategies and made necessary adjustments. Management should regularly measure the performance as well as compare the performance with predefined goals and objectives and make changes if required.Pulling up all together, step by step strategic process is required for smooth running of an organization in order to achieve its goals and objectives in modern competitive era.

2.9.7 Hierarchical Levels of Strategy

Strategy can be formulated on three different levels -
- corporate level
- business unit level
- functional or departmental level.

The role of the corporation is to manage its business units and products so that each is competitive and each contributes to corporate purposes.

Corporate Level Strategy:

Corporate level strategy is concerned with the selection of businesses in which the company should compete and with the development and coordination of that portfolio of businesses. Corporate level strategy is concerned with:
- Defining the issues that are corporate responsibilities; identifying the overall goals of the corporation, the types of businesses etc.
- Defining where in the corporation competition is to be localized.
- To develop synergies by sharing and coordinating staff and other resources across business units.
- To decide how business units are to be governed through direct corporate intervention

Business Unit Level Strategy:

A strategic business unit may be a division, product line, or other profit center that can be planned independently from the other business units of the firm.

- Positioning the business against rivals.
- Anticipating changes in demand and technologies and adjusting the strategy to accommodate them
- Influencing the nature of competition through strategic actions.
- Cost leadership, differentiation, and focus implemented at the business unit level to create a competitive advantage and defend against the adverse effects of the five forces.

Functional Level Strategy:

The strategic issues at the functional level are related to business processes and the value chain.

- Functional level strategies in marketing, finance, operations etc involve development and coordination of resources through which business unit level strategies can be executed effectively.
- Functional units of an organization are involved in higher level strategies by providing input into the business unit level and corporate level strategy, such as providing information on resources and capabilities on which the higher level strategies can be based.

2.10 BUSINESS PORTFOLIO MATRIX

Portfolio planning is a very useful tool. It is the method that helps the company executives to assess their firms prospects for a winning share within each of its industries. It offers suggestions about what to do within each industry, and ideas on how to allocate resources across industries. Portfolio planning determines the company's position within the industry. The management in charge of large firms involved in many different businesses must find out how to manage such portfolios.

2.10.1 Example for Portfolio Planning

For example, General Electric (GE) has a very wide variety portfolio of industries, including financial services, insurance, electricity generation, light bulbs, television, theme parks, robotics, medical equipment, railroad locomotives, and aircraft jet engines. GE executives, therefore, must make a decision about which units to grow, the ones to shrink, and the ones that needs to be abandoned.

2.10.2 BCG Matrix

The Boston Consulting Group (BCG) matrix is the most popular approach to portfolio planning. The matrix categorizes a firm's businesses as high or low along two dimensions: the market share and the growth rate of its industry.

Fig 2.7 The BCG Matrix

The high market share units that have a slow-growth industry are called cash cows. The profits generated from cash cows should not be invested back into cash cows but they should be diverted to more promising businesses.Low market share units that fall within slow-growing industries are called dogs. These units are good for divestments. High market share units that fall within fast-growing industries are known as stars. These units have very bright prospects and considered good candidates for growth. Low market share units that fall within fast-growing industries are called question marks. These units can either be converted into stars or divested.

2.10.3 Attractiveness Strength Matrix

The BCG matrix is not the only one portfolio planning technique. GE has developed the attractiveness-strength matrix to examine its portfolio of diverse activities. This planning technique involves rating each of the firm's businesses in regard to attractiveness and the firm's strength within the industry. Each dimension is divided into three categories that result in nine boxes. Each of these boxes have a given set of recommendations related with it.

2.10.4 Limitations of Portfolio Planning

Portfolio planning is a useful tool, but has important limitations. Portfolio planning oversimplifies the practical reality of competition by focusing only on a pair of dimensions while analyzing the company's operations within an industry. It is a useful tool but it can lead to motivational problems among employees. For example, if workers know that their firm is classified as a dog, then they may give up pushing ahead and lose all hope for the future. Portfolio planning does not identify any new scope. This tool only deals with existing businesses.

2.11 MODEL QUESTIONS

Part - A
1. What is planning?
2. Give the important aspect of planning.
3. What is the need for planning?
4. Mention the limitations of planning.
5. Give the types of plans.
6. What is budgeting?
7. What is the importance of decision making?
8. Mention any four factors related to decision making.
9. Compare programmed and non-programmed decisions.
10. Mention the other types of decisions.
11. What are the steps connected with decision making process?
12. Give the factors affecting decision making process.
13. What is Management Information system?
14. What are the characteristics of MIS?
15. What is DSS?
16. Mention the components of DSS.
17. What are the characteristics of DSS?
18. What is strategic planning?
19. Give the various steps connected with strategic planning.
20. What is portfolio planning?

Part – B
1. Explain in detail, the various elements of Planning.
2. Describe the process of Decision making with relevant diagram.
3. Explain the various factors affecting the process of Decision making in an organization.
4. Explain the concept of Management Information system (MIS), its components and characteristics with a neat sketch.
5. Explain the concept of Decision Support System (DSS) its components and characteristics with a neat sketch.
6. Describe briefly, how Strategic planning is implemented in an organization.
7. Write short notes on – (i) Types of Decisions (ii) Business Portfolio Matrix.

Unit III

ORGANIZING FUNCTION

3.1 ORGANIZATIONAL STRUCTURE

An organization is a social unit of individuals designed and managed to achieve collective goals. Every organization has its own typical management structure that defines and governs the relationships between the various employees, the tasks they perform, the roles, responsibilities and authority provided to carry out different tasks. An organization that is well structured achieves effective coordination and describes how separate actions of individuals are linked together. The structure an organization designs depends on its objectives and the strategy it adopts in achieving those objectives.

It is very important for an organization to take utmost care while creating the organizational structure. The structure should clearly determine the reporting relationships and the flow of authority as this will support good communication – resulting in efficient and effective work process flow. Managements need to consider how they wish to structure the organization. Some of the critical factors that need to be considered are −

- The size of the organization
- Nature of the business
- The objectives and the business strategy to achieve them
- The organization environment

3.1.1 Functional Organization Structure

The functional structure is the most common model found in most organizations. Organizations with such a structure are divided into smaller groups based on specialized functional areas, such as operations, finance, marketing, Human Resources, IT, etc. The organization's top management team consists of several functional heads. Communication generally occurs within each functional department and is communicated across departments through the department heads.
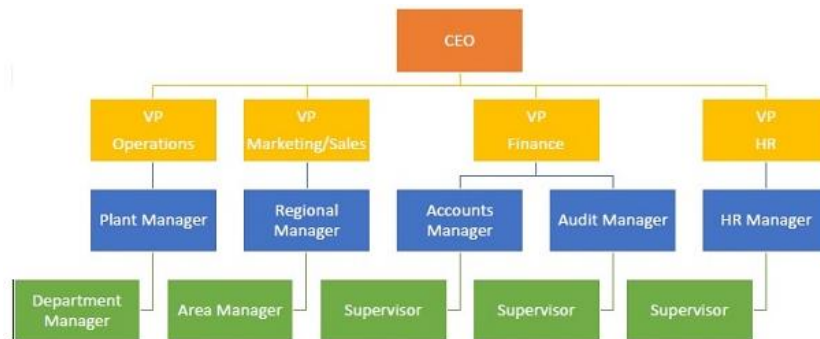

Fig 3.1 Functional Organizational Structure

Merits: This structure provides greater operational efficiency as employees are functionally grouped based on expertise and shared functions performed. It allows increased specialization as each group of specialists can operate independently.

Demerits: When different functional areas turn into silos they focus only on their area of responsibility and do not support other functional departments. Also expertise is limited to a single functional area allowing limited scope for learning and growth.

3.1.2 Product Organizational Structure

This is another commonly used structure, where organizations are organized by a specific product type. Each product category is considered a separate unit and falls within the reporting structure of an executive who oversees everything related to that particular product line. For example, in a retail business the structure would be grouped according to product lines.
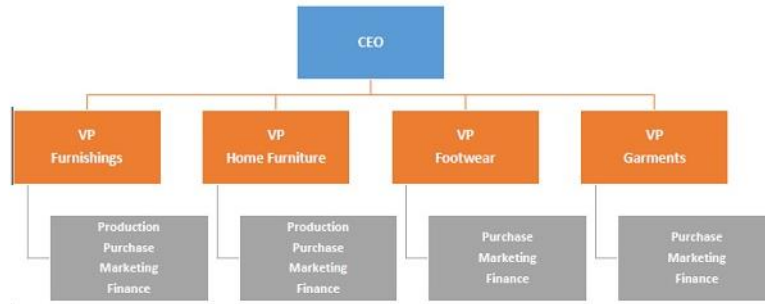
Fig 3.2 Product Organizational Structure

Merits: Organization structured by product category facilitates autonomy by creating separate processes from other product lines within the organization. It promotes depth of understanding within a particular product area and also promotes innovation. It enables clear focus with accountability for program results.

Demerits: This model has a few downsides like requirement of strong skills specializing in the particular product. It could lead to functional duplication and potential loss of control.

3.1.3 Geographic Organizational Structure

Organizations structure the company according to the geographic regions they operate in. This is typically found in organizations that go beyond a city or state limit and may have customers all across the country or the world.

Fig 3.3 Geographic Organizational Structure

Merits: It brings together employees from different functional specialties and allows geographical division. The organization responds more quickly and efficiently to market needs, and focuses efforts solely on the objectives of each business unit, increasing results.

Demerits: It reduces the overall efficiency of the organization, since geographical divisions duplicate both activities and infrastructure. It tends to be resource intensive as it is spread across and also leads to duplication of processes and efforts.

3.1.4 Matrix Organizational Structure

A matrix structure is organized to manage multiple dimensions. It provides for reporting levels both horizontally as well as vertically and uses cross-functional teams to contribute to functional expertise. These employees may belong to a particular functional group but may contribute to a team that supports another program.
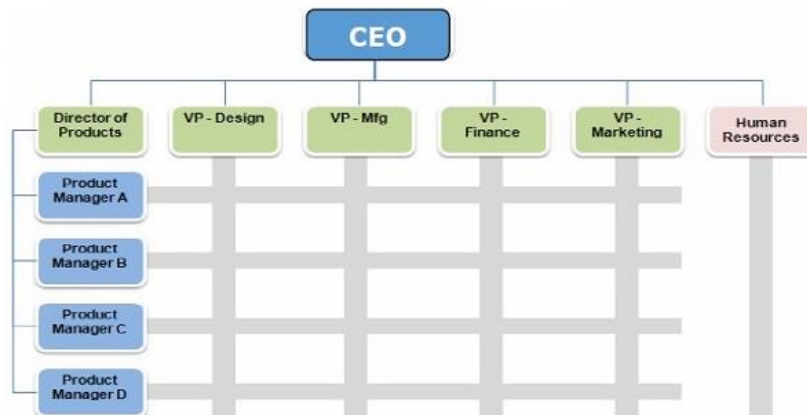
Fig 3.4 Matrix Organizational Structure

Merits: This type of structure brings together employees and managers across departments to work toward accomplishing common organizational objectives. It leads to efficient information exchange and flow as departments work closely together and communicate with each other frequently to solve issues. This structure promotes motivation among employees and encourages a democratic management style where inputs from team members are sought before managers make decisions.

Demerits: It often increases the internal complexity in organizations. As reporting is not limited to a single supervisor, employees tend to get confused to whom they report and whose direction to follow. This leads to communication gaps, and division among employees and managers.

3.2 JOB DESIGN

Job design follows job analysis. It aims at outlining and organising tasks, duties and responsibilities into a single unit of work for the achievement of certain objectives. It also outlines the methods and relationships essential for the success of a certain job. In simpler terms it refers to what, how much, how many and the order of the tasks for a job.

Job design essentially involves integrating job responsibilities and certain qualifications that are required to perform the same. It outlines the job responsibilities very clearly and also helps in attracting the right candidates to the right job. Further it also makes the job look interesting and specialised.

3.2.1 Steps involved in Job Design

There are various steps involved in job design that follow a logical sequence. The sequence is as follows:

- What tasks are required to be done?
- How are the tasks performed?
- What amount are tasks are required to be done?
- What is the sequence of performing these tasks?

All these questions are aimed at arriving upon a clear definition of a specific job and thereby make it less risky for the one performing the same. A well defined job encourages feeling of achievement among the employees and a sense of high self esteem.

3.2.2 Process of Job Design

The whole process of job design is to address various problems within the organisational setup, those that pertain to ones description of a job and the associated relationships. More specifically the following areas are fine tuned:

- Checking the work overload.
- Checking upon the work under load.
- Ensuring tasks are not repetitive in nature.
- Ensuring that employees don not remain isolated.
- Defining working hours clearly.
- Defining the work processes clearly.

The above mentioned are factors that if not taken care of result into building stress within the employees.

3.2.3 Tools of Job Design

The following are the tools used for job design.

- Process Flowchart
- Motion Study
- Work measurement
- Stopwatch time study
- Standard elemental times
- Work Sampling
- Learning Curve

3.2.4 Benefits of Job Design

The following are the benefits of a good job design -

- **Employee Input:** A good job design enables a good job feedback. Employees have the option to vary tasks as per their personal and social needs, habits and circumstances in the workplace.
- **Employee Training:** Training is an integral part of job design. Contrary to the philosophy of "leave them alone' job design lays due emphasis on training people what their job demands and how it is to be done.
- **Work / Rest Schedules:** Job design offers good work and rest schedule by clearly defining the number of hours an individual has to spend in his job.
- **Adjustments:** A good job designs allows for adjustments for physically demanding jobs by minimising the energy spent doing the job and by aligning the manpower requirements for the same.

Job design is a continuous and ever evolving process aimed at helping employees make adjustments with the changes in the workplace. The end goal is reducing dissatisfaction, enhancing motivation and employee engagement at the workplace.

3.3. DEPARTMENTATION
3.3.1 Meaning of Departmentation
Departmentation is the foundation of organization structure. Departmentation means division of work into smaller units and their re-grouping into bigger units on the basis of similarity of features. Each department is headed by a person known as departmental manager. Division of work into departments leads to specialization as people of one department perform activities related to that department only. Departmentation provides scope for organization's growth and expansion. There are two forms of Organizational structure or departmentation -
- Functional departmentation
- Divisional departmentation

3.3.2 Functional Departmentation
It is grouping of activities on the basis of similarities of functions. The nature of activities performed by different organizations is different. Activities carried by a manufacturing concern are production, finance, personnel and sales. For a trader, the major activities are buying and selling. A bank performs the activities of borrowing and lending. The major functional departments further have derivative departments. Production department, for example, has departments to handle purchasing, production planning and control, manufacturing etc.
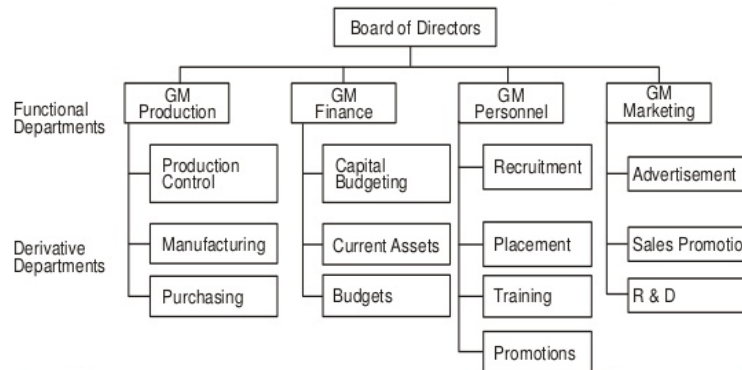

Fig 3.5 Functional Departmentation

Merits of Functional Departmentation:
- Simple and logical basis of creating departments
- Specialization
- Co-ordination
- Training and control
- Supervision
- Suitable for stable organizations
- Suitable for small organizations

Demerits of Funtional Departmentation:
- Delayed decisions

- Co-ordination
- Holding of accountability
- Unsuitable for dynamic organizations
- Complexity

3.3.3 Divisional Departmentation

Divisional structures are created on the basis of smaller divisions where each division has its own functional activities (production, finance, personnel and marketing). Major divisions that determine the organisaion structure are -

- Product departmentation
- Process departmentation
- Customer departmentation
- Geographic departmentation
- Departmentation by Time
- Departmentation by Size
- Departmentation by Task Force

3.3.4 Product Departmentation

This form of departmentation is suitable for companies that produce multiple products. Product departmentation is grouping of jobs and resources around the products or product lines that a company sells. The focus is on the product line and all functional activities associated with the product line. Departments are created on the basis of products and product manager has the authority to carry out functional activities for his department.
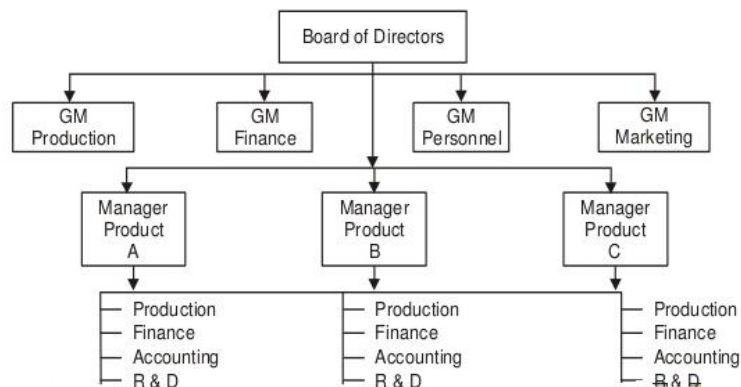

Fig 3.6 Product Departmentation

Merits of Product Departmentation:

- Better performance
- Flexibility
- Faster decisions
- Co-ordination
- Control
- Responsibility
- Efficiency

Demerits of Product Departmentation:

- Co-ordination

- Expensive
- Control

3.3.5 Process Departmentation

In manufacturing organizations, where the product passes through different stages of production, each stage is designated as a process and departments created on the basis of processes is called process departmentation. For each process, departments are created and headed by people who are skilled and competent to carry that process.
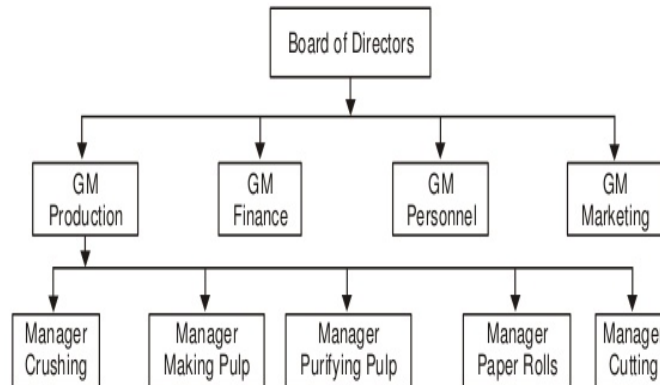

Fig 3.7 Process Departmentation

Merits of Process Departmentation:
- Specialization
- Economic considerations
- Technological consideration
- Facilitates training

Demerits of Process Departmentation:
- Co-ordination
- Boredom

3.3.6 Customer Departmentation

When organizations sell goods to customers with different needs, departments on the basis of customers is the suitable form of departmentation. It is "the organizing of jobs and resources in such a way that each department can carefully understand and respond to the different needs of specific customer groups". Clear identification of customers and their needs is the basis of departmentalization.
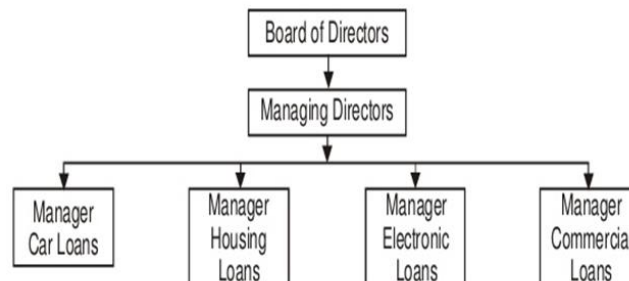

Fig 3.8 Customer Departmentation

Merits of Customer Departmentation:
- Competitive advantage
- Customer orientation

- Specialization

Demerits of Customer Departmentation:
- Co-ordination
- Identification of consumer groups
- Change in consumer behavior
- Specialized staff

3.3.7 Geographic Departmentation

In territorial departmentation, organization creates departments (*i*) close to its customers because they are geographically dispersed over different areas, or (*ii*) near the sources of deposits. Each geographic unit has resources to cater to the needs of consumers of that area. General Manager of every department looks after functional activities of his geographical area while overall functional managers provide supporting services to the managers of different areas.
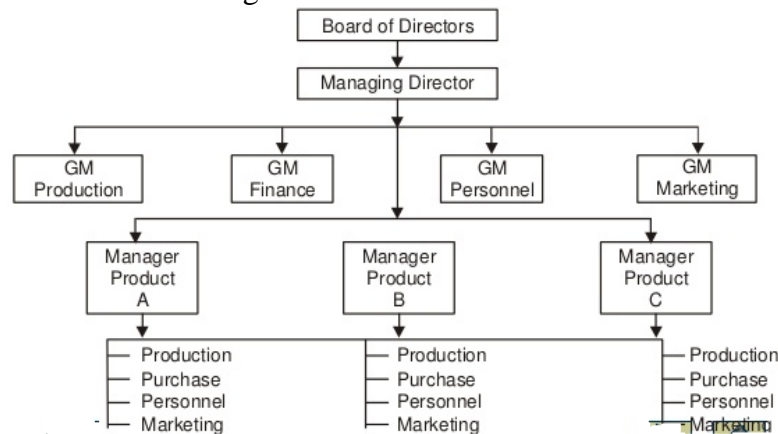

Fig 3.9 Geographic Departmentation

Merits of Geographic Departmentation:
- Training and development
- Customer orientation
- Low cost of production
- Communication

Demerits of Geographic Departmentation:
- Co-ordination and control
- Expensive
- Managerial skills

3.3.8 Departmentation by Time, Size & Task Force

By Time: This method of departmentation is used in situations where work is done round the clock because -
- The machine cannot be stopped before finishing the work
- The demand is high and the machine has to work overtime
- The nature of work entrusted to the organizations is such (Airlines or Railways)
- The services are essential in nature (health and fire services).
- Workers work in shifts; morning, afternoon and night, so that work can progress continuously.

By Size: This method is followed in army where number of workers in the unit is important. The company's performance is judged by the number of people working with it, and therefore, it adopts departmentation by size.

By Task Force: When organization takes up different projects, it forms task forces, which consist of people from different units having different skills to carry out those projects. These groups are formed temporarily to work till completion of the project. They are similar to project organizations.

3.4 SPAN OF CONTROL

Span of control (also referred to as Span of Management) refers to the number of employees who report to one manager. It is the number of direct reportees that a manager has and whose results for. Span of control is critical in understanding organizational design and the group dynamics operating within an organization. Span of control may change from one department to another within the same organization.

The span may be wide or narrow. A wide span of control exists when a manager has a large number of employees reporting to him. Such a structure provides more autonomy. A narrow span of control exists when the number of direct reportees that a manager has is small. Narrow span allow managers to have more time with direct reports and they tend to spark professional growth and advancement.

The following are the factors affecting Span of Management -

- Capacity Of Superior
- Capacity Of Subordinate
- Nature Of Work
- Degree Of Decentralization
- Degree Of Planning
- Communication Technique
- Use Of Staff Assistance
- Supervision From Others.

There are two types of Span Management –

- *Narrow Span of Management*
- *Wide Span of Management*:

3.4.1 Narrow Span of Management

This means a Single Manager Or Supervisor oversees few subordinates. This gives a rise to a Tall Organizational Structure. Large, complex organizations often require a taller hierarchy. In its simplest form, a tall structure results in one long chain of command similar to the military.
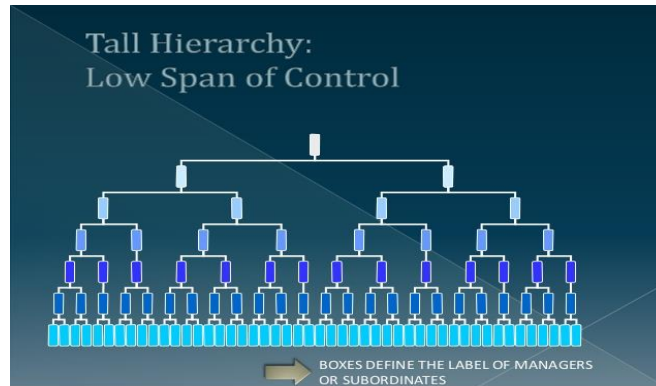
Fig 3.10 Tall Hierarchy – Narrow Span of Management

Advantages:

- Within tall organizational structure there is a close supervisory control because of the low span of managers.
- It is more authorized structure.
- The responsible person is other accountable to the higher authority.
- This structure enhance the control of the top regulation over the organization.

Disadvantages:

- Employees are less motivated within this structure.
- Verdict making is slow.
- Tall structure creates communication barriers between the upper and lower management.
- Less benefit and rewards are given to the body in the tall organization.

3.4.2 Wide Span of Management

This means a single manager or supervisor oversees a large number of subordinates. This gives a rise to a flat structure. Flat structures have fewer management levels, with each level controlling a broad area or group. By encouraging autonomy and self-direction, flat structures attempt to tap into employees creative talents and to solve problems by collaboration.
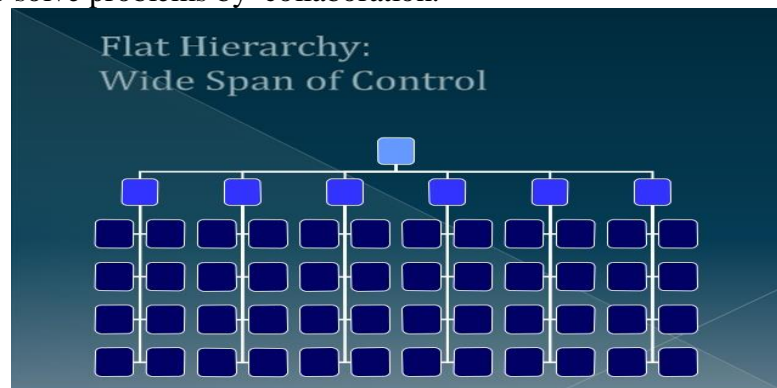

Fig 3.11 Flat Hierarchy – Wide Span of Management

Advantages:

- Flat Organization is less costly.
- Quick decision and action can be taken.
- Fast and Clear communication .
- Subordinates are free from close and strict supervision and control.

- Superior may not be too dominating because of large number of subordinates.

Disadvantages:
- There are chances of loose control because there are many subordinates under one managers.
- The discipline in the organization may be bad.
- The relation between the superior and subordinate may be bad.
- Close and informal relation may not be possible.
- And because of all these the quality of performance my be bad.

3.4.3 Better Span of Management

Narrow span of management is more costly compared to Wide span of management as there are large number of superior/managers and thus there is great communication issues too between various management levels. For example, the same number of workers requirement of supervisory personnel at span of 4 is 1,365 and at span of 8 is only 585. Therefore, looking into the cost of employment of personnel and their availability, it is preferable to go for wider span of management.

3.5 DELEGATION OF AUTHORITY

It is the practice of turning over work-related tasks and/or authority to employees or subordinates. Without delegation, managers do all the work themselves and underutilize their workers. The ability to delegate is crucial to managerial success. Authority is said to be delegated when discretion is vested in a subordinate by a superior. Delegation is the downward transfer of authority from a manager to a subordinate. Superiors or managers cannot delegate authority they do not have, however, high they may be in the organizational hierarchy.

Delegation as a process involves establishment of expected outcomes, task assignment, delegation of authority for accomplishing these tasks, and exaction of responsibility for their accomplishment. Delegation leads to empowerment, as employees have the freedom to contribute ideas and do their jobs in the best possible ways.

The following are the characteristics and sources of authority -

Characteristics:
- Basis of getting things done
- Legitimacy
- Decision-making
- Implementation

Sources:
- The formal authority theory
- The acceptance of authority theory
- The competence theory

3.5.1 Sources of Authority

The Formal Authority Theory: Authority flows from top to bottom through the structure of an organization.
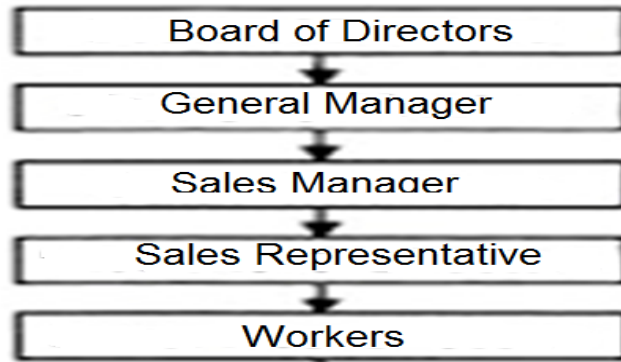
Fig 3.12 The Formal Authority Theory

The Acceptance of Authority Theory: Authority flows from the superior to the subordinates whenever there is an acceptance on the part of the subordinates. Zone of acceptance depends upon various factors like rewards, subordinate behavior pattern, dismissal or non acceptance results, special knowledge, confidence etc.

The Competence Theory: This type of authority is invested with the persons by virtue of the office held by them.

3.5.2 Principles of Delegation
The following are the principles of delegation.
- Delegation to go by results expected
- Delegation of authority but Non-delegation of responsibility
- Authority and responsibility should commensurate with each other
- Unity of command
- Definition of limitations of authority

3.5.3 Types of Delegation
The following are the types of delegation.
- General delegation
- Specific delegation
- Writing delegation
- Unwritten delegation
- Formal delegation
- Informal delegation
- Downward delegation
- Accrued delegation
- Sideward delegation

3.5.4 Advantages and Disadvantages of Delegation
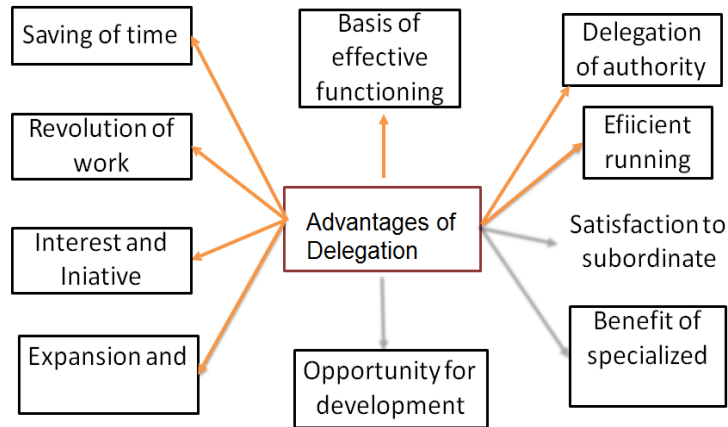The advantages of delegations are shown in Figure 3.13.

Fig 3.13 Advantages of Delegation

Disadvantages of Delegation:

- Hesitation on the part of Subordinates / Reasons
- Love of spoon feeding
- Easier to ask
- Fear of criticism
- Lack of Information or resources
- Lack of self confidence
- Inadequate incentives
- Fear of Failure

3.5.5 Effective Delegation of Authority

The following factors indicate the pre-requisite for effective delegation of authority.

- Superior must understand the authority and responsibility of their own.
- Superior must decide the portion of his authority that is to be delegated.
- Superior should have knowledge of abilities and inabilities of subordinates
- He must ensure the subordinates have understood the delegated work.
- He should delegate only the routine functions to subordinate
- He must understand the need, importance and value of delegation
- Adequate communication network
- Clear definition of standard of accountability
- Delegation must be done in accordance with overall plan.
- Delegation of authority should be confined to organizational structure

3.6 DE-CENTRALIZED AUTHORITY

Henri Fayol, a French mining engineer and director of mines developed a general theory of business administration. He and his colleagues developed this theory independently of scientific management but roughly contemporaneously. He was one of the most influential contributors to modern concepts of management. Fayol has introduced the 14th principles of management which are very dynamic in nature. Among those the 8th principle is Centralization and De-Cenralization.

3.6.1 Centralization Vs De-centralization

Centralization is the systematic and consistent reservation of authority at central points in the organization. The implications of centralization can be :-

- Reservation of decision making power at top level.

- Reservation of operating authority with the middle level managers.
- Reservation of operation at lower level at the directions of the top level.

Decentralization is a systematic delegation of authority at all levels of management and in all of the organization. "Everything that increasing the role of subordinates is decentralization and that decreases the role is centralization". Authority in retained by the top management for taking major decisions. Decentralization pattern is wider is scope.
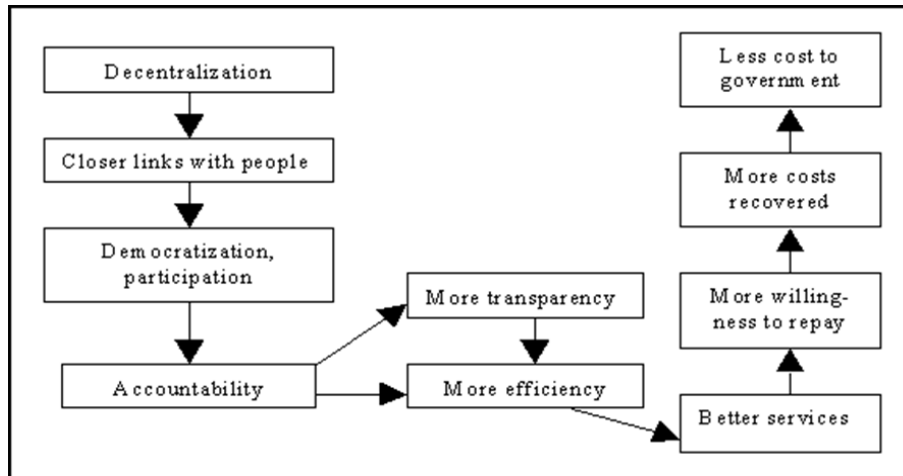

Fig 3.14 De-centralized Model

3.6.2 Advantages and Disadvantages of Centralization

Advantages:
- Reduced cost
- Uniformity in action
- Personal leadership
- Flexibility
- Improved quality of work
- Better co-ordination

Disadvantages:
- Delay in work
- Remote control
- No loyalty
- No Secrecy
- No special attention

3.6.3 Advantages and Disadvantages of De-centralization

Advantages:
- Distribution of burden of top executive
- Increased motivation and morale
- Greater efficiency and output
- Diversification of Activities
- Better Co-ordination
- Maintenance of Secrecy
- Facilitate effective control and quick decision

Disadvantages:

- More cost
- No specialization
- Need more specialists
- No uniform action
- No equitable distribution of work
- Control Systems
- Types of Business
- Branches of organization

3.6.4 Factors influencing Centralization and De-centralization

Centralization:
- Size and dispersal of operation
- Level of diversity of product-lines
- Nature of growth
- Nature of Business
- Quality of Executives
- Management by Exception
- Effective Control System

De-centralization:
- Size of the organization – large or small
- Cost and Importance of decisions
- Uniformity
- History of organization
- Management Philosophy
- Availability of efficient managers
- Type of business
- Branches of organization

3.6.5 Examples for De-centralized Organizations

Open Source Software: There are two decentralized organization examples in the computing world. The first is Open Source Software. Think Linux. It's freely available, thousands of volunteers update it and nobody owns it.

Peer to Peer Software: Peer to Peer software is uses bits of information contributed by many people. For example, Bit Torrent downloads a part of the overall file from numerous computers spread across the globe.

Terrorist Cells: Terrorist cells represent the best military decentralized organization example. And, this explains the difficulty the west has had in coming to terms with Al Qaeda, finding Osama Bin Laden and the war in Afghanistan. It's the centralized versus the decentralized.

The Internet: This is the classic decentralized organization example of our time. It was deliberately created to overcome the limits of a centralized military command and the threat of missile attack. This decentralized structure is built upon the humble hyperlink that connects all the separate pages, websites and networks.

3.7 CHAIN OF COMMAND

The chain of command is an important concept to build a robust organization structure. It is the unbroken line of authority that links each individual with the top organizational position through a managerial position at each successive layer in between.

It is an effective business tool to maintain order and assign accountability even in the most casual working environments. A chain of command is established so that everyone knows whom they should report to and what responsibilities are expected at their level. A chain of command enforces responsibility and accountability. It is based on the two principles of Unity of command and Scalar Principle.

3.7.1 Unity of Command

Unity of command states that an employee should have one and only one manager or supervisor to whom he is directly accountable to. This is done to ensure that the employee does not receive conflicting demands or priorities from several supervisors at once, placing him in a confused situation. However, there are exceptions to the chain of command under special circumstances for specific tasks if required. But for the most part organizations to a large extent should adhere to this principle for effective outcomes.

3.7.2 Scalar Principle

Scalar principle states that there should exist a clear line of authority from the position of ultimate authority at the top to every individual in the organization, linking all the managers at all the levels. It involves a concept called a gang plank using which a subordinate may contact a superior or his superior in case of an emergency, defying the hierarchy of control. However, the immediate superiors must be informed about the matter.

3.7.3 Reporting Relationships

The reporting relationships established in the final step of organizational design are easy to see on an organizational chart, which depicts a company's structure. Starting at the bottom, each position is connected to one above it by a line. Following the line vertically from position to position reveals the chain of command. Each person is one link in the chain.

3.8 LINE AND STAFF CONCEPT

Line and Staff are names given to different types of functions in organizations. A "line function" is one that directly advances an organization in its core work. This is always production and sales, and sometimes also marketing. A "staff function" supports the organization with specialized advisory and support functions. For example, human resources, accounting, public relations and the legal department are generally considered to be staff functions.

3.8.1 Line and Staff Hierarchy

Line and staff management has two separate hierarchies:

The Line hierarchy in which the departments are revenue generators (manufacturing, selling), and their managers are responsible for achieving the organization's main objectives by executing the key functions (such as policy making, target setting, decision making).

The Staff hierarchy, in which the departments are revenue consumers, and their managers are responsible for activities that support line functions (such as accounting, maintenance, personnel management).

While both hierarchies have their own chains of command, a line manager may have direct control over staff employees but a staff manager may have no such power over the line employees. In modern practice, however, the difference in the two hierarchies is not so clear-cut and jobs often have elements of the both types of functions.
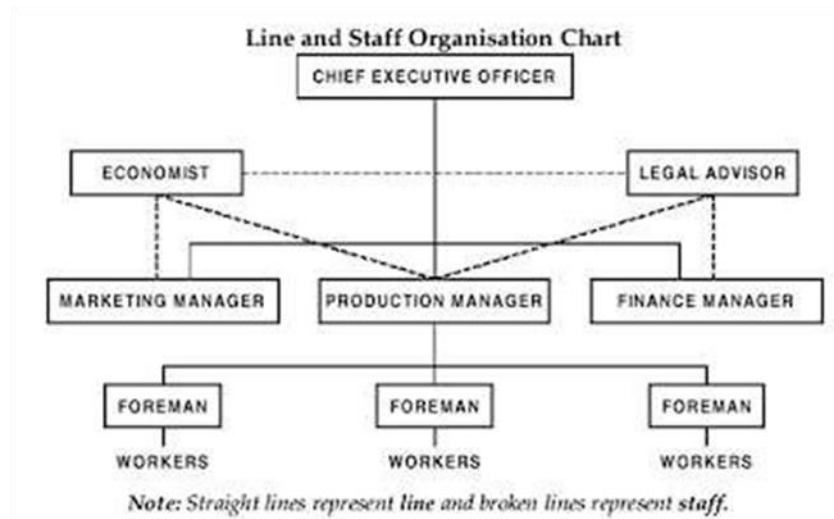

Fig 3.15 Line and Staff Organization Chart

3.8.2 Line and Staff Organiztion

Line Organization:

Line structure consist of direct vertical relationship which connects the position and task of each level with those above and below it. It represent the structure in direct virtual relationship through which authority travels.

Advantages:
- Clear cut relationship.
- Unity of command.
- Prompt decision making.
- Effective coordination.
- Fixed responsibility.
- Discipline.

Disadvantages:
- Difficulty in staffing.
- Concentration of authority.
- Lack of specialization.
- Instability.
- Poor motivation.
- Ineffective communication.
- Not useful for larger enterprises

Staff Organization:

Staff organization is the person of the organization who provide advice and service to line. They provide expert advice on important matters. They enable line people to work more efficiently. They cannot directly issue orders to subordinates in line departments.

Advantages:
- Specialization.
- Growth and Expansion.
- Lesser burden on line executives.
- Better decisions.
- Training of Line executives.
- Advancement of Research.

Disadvantages:
- Different orientation.
- Conflict Between line and staff.
- Lack of responsibility.
- Lack of co-ordination.
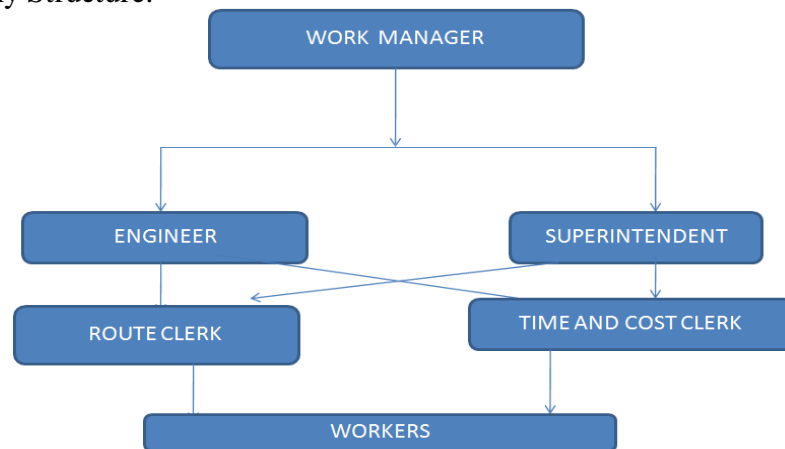- Excessive reliance on staff.
- Costly Structure.

Fig 3.16 Staff Organization Chart

3.8.3 Role of Line Managers and Staff Managers

Line Managers:
- Formulating the objectives, plans and policies.
- Making decisions for the implementation of plans and policies and attainment of objectives.
- Providing supervision and leadership, achieving coordination and exercising control.

Staff Managers:
- Advice, help and guide the line managers in the performance of the above functions.
- Provide specified administrative services.
- Interpret objective plans and policies.
- Make the best tools available for the implementation of plans and policies. Help in the selection and training of employees.

- Measure organizational effectiveness.

3.8.4 Line and Staff Conflict

Line and staff relationship is based on the assumption that both support each other and work harmoniously to achieve organizational objectives. However, there are frequent instances of conflict between line and staff in the organization. This generates lots of friction and loss of time and consequently loss of organizational effectiveness. Therefore, there is a need for analyzing the sources of line and staff conflict and then to take actions to overcome the problem of conflict.

These relations are often characterized more by conflict than cooperation. Staff specialists complain that line managers are resistant to their ideas and the line managers complain that staff managers are sky-gazing specialists with no comprehension of practical situations.

3.9 MATRIZ ORGANIZATIONAL DESIGN

This idea was generated from US space program. In 1960's, American president Mr. Kennedy outline his vision to put man on moon. Hence to fulfill this vision NASA has design a new structure, popularly known as matrix structure. The design get popularity in 1970s and 1980s when big companies like IBM, HP, Nestle and CITI Bank used this structure.

A matrix organization is defined as an organization where people have to report to more than one boss. The matrix organization structure is blend of projectized organization and the functional organization and takes the best of the both world. Here the knowledge, skill and talent of an employee is shared between the functional department and project management. In matrix organization, some employee usually work under more than one boss. The first boss will be their functional manager and the other can be a project manager.

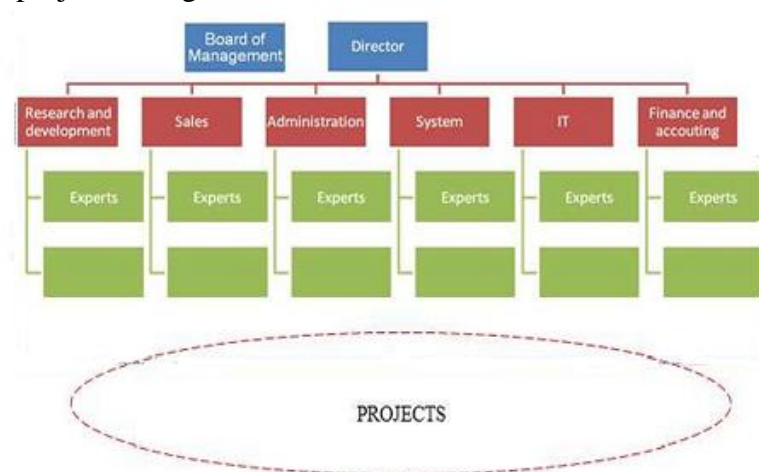
Fig 3.17 Structure of Matrix Organization

3.9.1 Functional Structure and Project Structure

Functional Structure:

The functional manager controls the structure. People are grouped as per their area of specialization. They are supervised by manager who has expertise on the same field. The authority and power flows downwards. This structure tells the character and values of organization.

Project Structure:
 The activities are arranged through portfolio and implemented through project. The project manager controls the project. The authority and power flows side ways. They are responsible for completing the project within a specific deadline and budget. The individuals are chosen as per need of project

3.9.2 Types of Matriz Structure
 There are three types of matrix structure –
- Strong Matrix structure
- Balanced Matrix structure
- Weak Matrix Structure

Strong Matrix Structure
- Power and authority lies with project manager
- Project manager have a full time role
- Project manager have administrative staff under him
- Project manager control the project budget
- Have a lot of characteristics of projectized organization
- Functional manager have limited role
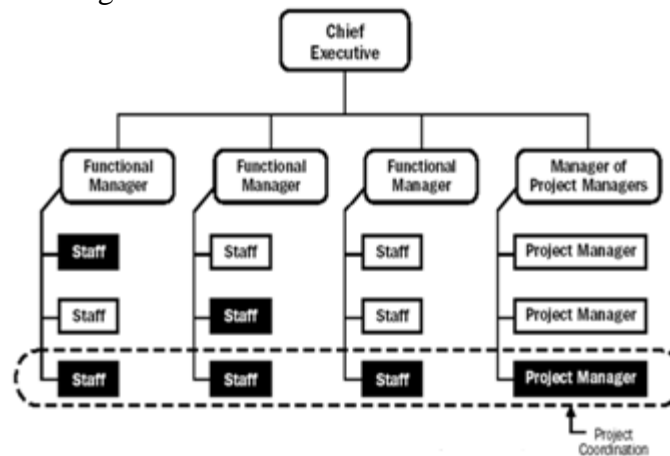
Fig 3.18 Strong Matrix Structure

Balanced Matrix Structure
- Power and authority are shared between both the manager
- Project manager have a full time role
- Project manager have a administrative staff under him
- Both manager controls the project

Fig 3.19 Balanced Matrix Structure

Weak Matrix Structure

- Project manager have a limited power and authority
- Project manager have a part time role
- No administrative staff will report to him
- Project manager have the role of coordinator
- Functional manager controls the project

Fig. 3.20 Weak Matrix Structure

3.10 MODEL QUESTIONS
Part – A
1. What is meant by Organizational Structure?
2. Give the types of Organizational Structure.
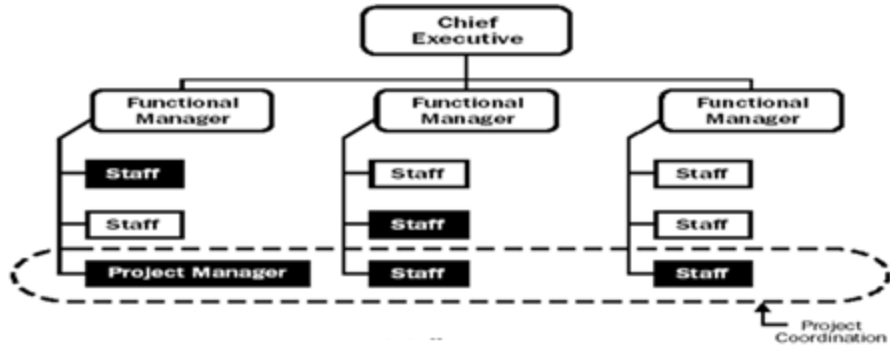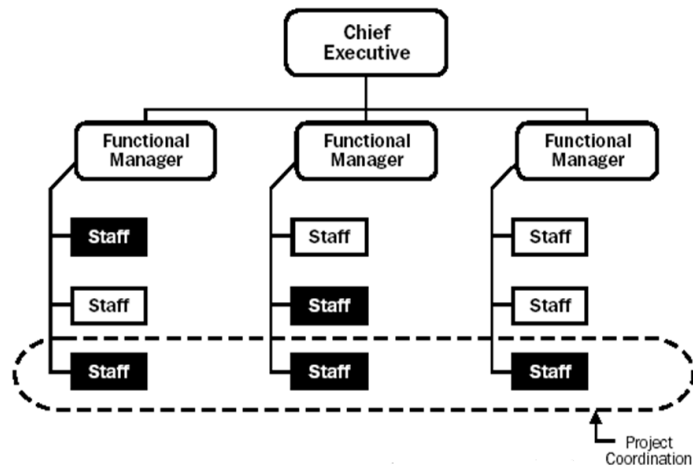3. What is Virtual organizational structure?
4. Mention the features of organizational structure.
5. What are the key parameters relevant to organizational structure?
6. Mention any four purposes of organizational structure.
7. What is Job design?
8. What are the elements of Job design?
9. Give the core characteristics of Job design.
10. Mention the approaches to Job design.
11. What is Departmentation? Give its forms.
12. Give the merits and demerists of Product departmentation.
13. What is divisional departmentation?
14. What is customer departmentation?
15. What is span of control?
16. Mention any four factors affecting span of management.
17. What are the advantages of Tall structure?
18. What is delegation of authority?
19. Give the characteristics and sources of authority.
20. What is Competence theory?
21. What are the elements of delegation?
22. Give four types of delegation.
23. Mention any four advantages of delegation.
24. Differentiate between Centralization and De-centralization.
25. What are the advantages of Centralization?
26. Give examples for De-centralized Organizations.
27. What is Chain of command?
28. Differentiate between Line and Staff Hierarchies.
29. What are the advantages of Line organization?
30. Give the disadvantages of Staff organization.
31. What is Matrix Organization?
32. Give the types of Matrix Structure.

Part – B
1. Describe in detail, the various types of Organizational Structures with relevant diagrams.
2. Explain the various characteristics, approaches and tools used for Job design.
3. Explain the various types of Departmentation in detail.
4. Write a short note on types of Span of Management with neat sketches.
5. Explain the theories of delegation of authority with examples.
6. Write short notes on – (i) Chain of Command (ii) De-centralization.
7. Explain the concept of Line and Staff Organization with relevant diagrams.
8. Describe briefly the principle of Matrix Orgnizational design in an organization.

Unit IV

ENGINEERING ETHICS

4.1 SENSES OF ENGINEERING ETHICS

Ethics are principles followed depending upon the moral responsibility that a person feels. The study of related questions about moral ideals, character, policies and relationships of people and organizations can be termed as Engineering ethics. An engineer works for a company, has to go through some ethical issues under the conditions such as, conceptualization of a product, issues arising in design and testing departments, or issues involving the manufacturing, sales and services.

The ethical decisions and moral values of an engineer need to be considered because the decisions of an engineer have an impact on the products and services – of the company and its shareholders, the public and the society who trusts the company, the law which cares about how legislation affects the profession and industry, the job and his moral responsibilities etc.

4.1.1 Steps to deal with Issues

The following are the issues faced by the engineers with patience and few moral goals.

- *Moral Awareness*: Able to recognize the moral problems and issues that occur in Engineering. The analysis on the problem is necessary to differentiate and judge according to ethics.
- *Cogent Moral Reasoning*: The argument has to be assessed and comprehended In order to come to a conclusion on an issue,
- *Moral Coherence*: The consistent and comprehensive view points are to be formed after going through all the logical and moral facts,
- *Moral Imagination*: The moral issues and the practical issues have to be dealt separately.
- *Moral Communication*: The moral views should be precise and clear so that the expression or words should not alter the original meaning.

4.1.2 Skills for Ethical Reasoning

The following are the various skills required for Ethical Reasoning -

- *Moral Reasonableness*: The ability and willingness to be morally reasonable required while dealing such issues.
- *Respect for Persons:* The persons involved in the issue, should be treated with genuine concern by one.
- *Tolerance of diversity*: One should have a broader perspective towards ethnic and religious differences that the people have.
- *Moral hope*: The moral conflicts can be resolved by using better communication and rational dialogue which is evident-based and open-ended.
- *Integrity*: The moral integrity has to be maintained. Being honest and having strong moral principles helps one to resolve an issue in an efficient manner.

4.2 MORAL ISSUES

Morals are the principles or habits with respect to right or wrong of one's own conduct. They are not imposed by anyone. Morals are what we think is good and bad personally. A moral issue is an issue to be resolved not only by considering the technical stuff but also by keeping moral values in mind.

"Moral issue is a working definition of an issue of moral concern is presented as any issue with the potential to help or harm anyone, including oneself."

4.2.1 Types of Moral Issues

There are mainly two types of Moral issues while keeping the ethical aspects in mind to respond. They are −

Micro-ethics: This approach stresses more on the problems that occur on a daily basis in the field of engineering and its practice by engineers.

Macro-ethics: This approach deals with social problems which are unknown. However, these problems may unexpectedly face the heat at both regional and national levels.

4.2.2 Examples for Moral Issues

Example 1:

After a recent collapse of a structure in which many people died, an Engineer came to know about a bridge which is marginally safe. He informed his superior who asked him to stay calm and not to discuss with anyone, while waiting for the next year budget sessions to get some financial help for the repair required. What should the engineer do?

Example 2:

What should an Engineer who observes his colleague copying confidential information unauthorized, do immediately? If he chooses to stop his friend, what if this gets repeated without his notice? If he chooses to report the management, what if his friend loses the job? Which is morally correct?

Example 3:

An engineer who develops a proto-type for the project, loses it due to a mishap exactly the day before the submission. Is it morally correct to outsource the prototype of the project and reduce the risks of job insecurity? What should he do?

These are the few examples to understand the kind of moral dilemmas. There might be one or more correct answers at times. However, the decisions have to be made by following a slow and clear process in order to avoid further problems and also to solve this in a efficient manner.

4.3 TYPES OF INQUIRIES

The issues can be resolved by following an investigation procedure, step by step in order to have a clear understanding towards the issue. Judging the issues has to be followed by a systematic procedure to avoid any flaws. Engineering ethics involves investigations into values, meanings and facts. The following are the different types of inquiries made for this.

- Normative inquiries
- Conceptual inquiries
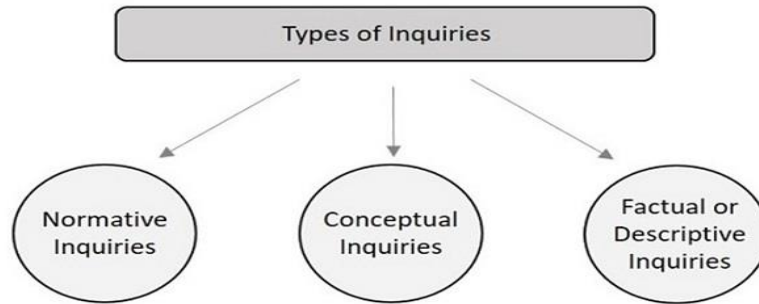- Factual or descriptive inquiries

Fig 4.1 Types of Inquiries

4.3.1 Normative Inquiries

Normative Inquiry describes what one ought to do under a specific circumstance. This is the expected ideal response, which might differ from what one believes to be right or wrong. This list identifies and justifies the morally desirable nature for guiding individuals or groups. This includes the responsibility of engineers to protect the public safety and how they should respond under such dangerous practices. Normative inquiries also quote the laws and procedures that affect the engineering practice on moral grounds. They refer to the thought process where the moral rights are to be implemented in order to fulfill their professional obligations.

4.3.2 Conceptual Inquiries

Conceptual Inquiry refers to the description of the meaning of concepts, principles and issues related to engineering ethics. The ethics that an engineer should possess to protect the safety, health and welfare of the public are described under conceptual inquiries.

It describes what safety is and mentions the marginal issues of safety along with the precautions an engineer should take to avoid risk. Conceptual inquiries mention the moral aspects of bribery and its effects, along with the professional ethics and professionalism.

4.3.3 Factual and Descriptive Inquiries

Factual Inquiry help to provide the facts for understanding and finding solutions to the value based issues. The engineer has to conduct factual inquiries by using scientific techniques. This helps in providing the information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies, the procedures to be adopted when assessing risks and psychological profiles of engineers.

4.4. MORAL DILEMMAS

At times, the situations occur where one cannot make immediate decisions as the moral reasons come into conflict. The moral reasons can be rights, duties, goods or obligations, which make the decision making complex.

4.4.1 Types of Complexities

The difficulties in arriving to a solution, when segregated, can be divided into the following three sections.

Vagueness: This refers to the condition where the doubt lies in whether the action refers to good or bad. This sometimes includes the unwritten rules like being loyal, having respect, maintaining confidentiality, etc.

Conflicting reasons: When knowing the solutions available with us, the making of better choice among the ones, will be the internal conflict. Fixing the priorities depends upon the knowledge and the moral values one has. The reason why the particular choice is being made, makes sense.

Disagreement: When there are two or more solutions and none among them is mandatory, the final solution selected should be best suitable under existing and the most probable conditions. The interpretation regarding the moral reasons behind the choice and analysis should be made keeping in mind whether this is the better or the worse solution in the probable aspects.

4.4.2 Steps in Facing Moral Dilemmas

Whenever a person is faced with a moral dilemma, the issue is to be solved with a stepwise approach as this will generate a better output. The steps include the following −

Identification:

The step of identification involves the following −

- The issue has to be thoroughly understood.
- The duties and the responsibilities of the persons involved are to be clearly known.
- The moral factors related to the issue are to be understood.
- The conflicting responsibilities, the competing rights and the clashing ideas involved are to be identified.

Ranking:

The considerations in the issue are to be listed down. Then they have to be ranked according to the priorities. The moral aspect has to be considered to rank the issues. The advantages of a single person should never be given any importance unless any moral reason is there behind it.

Inquiries:

The inquiry of details involved in the issue is to be completely made. All the facts related to the issue are brought into light. Considering the alternative courses of action for resolving and tracing, full implications are also needed.

Discussions:

Discussions are to be made with other members, as different minds look at the issue in different views to give different solutions. The complete analysis of a problem gives chances to different viewpoints from which a better solution can be drawn.

Final Solution:

After analyzing different perspectives and considering the facts and reasons on the basis of truths and understanding the flaws which lead to the issue, a final solution has to be drawn out. This solution will add value to the whole analysis, in all aspects.

4.5 MORAL AUTONOMY

Moral Autonomy is the philosophy which is self-governing i.e., acting independently without the influence or distortion of others. The moral autonomy relates to the individual ideas whether right or wrong conduct which is independent of ethical issues. The concept of moral autonomy helps in improving self-determination. Moral Autonomy is concerned with independent attitude of a person related to moral/ethical issues. This concept is found in moral, ethical and even in political philosophy.

4.5.1 Skills Needed for Moral Autonomy
      The following are the skills needed for moral autonomy -
1) Ability to relate the problems with the problems of law, economics and religious principles:
      It is essential to have the ability to analyze a problem and finding the relation with the existing law or the topic of issue with the existing principles on that topic. The ability to distinguish between both of them and finding the moral reasons.
2) Skill to process, clarify and understand the arguments against the moral issues:
      If the issue is against some moral values to be followed in the society, then clarity should be maintained about the differences and similarities. Both of these differences and similarities are to be judged based on why they are a matter of concern and in what aspect.
3) Ability to suggest the solutions to moral issues on the basis of facts:
      If the moral issues are not fulfilling, then the solutions are to be suggested according to the moral issues based on the facts and truths of the issue. These suggestions must be consistent and must include all the aspects of the problem.
4) Must have the imaginative skill to view the problems from all the viewpoints:
      After having known about the facts and illusions of the issue, a clear understanding is attained in viewing the problem in all kinds of viewpoints. This enables one to be able to suggest a proper alternative solution.
5) Tolerance while giving moral judgment, which may cause trouble:
      When the whole analysis is made considering all the viewpoints of the issue, the final output might be or might not be pleasing to the persons involved. Hence while declaring the judgment a detailed description of the actions done should be given and while the actions ought to be done should be presented in a better way.

4.5.2 Skills for Improving Moral Autonomy
   Moral autonomy reflects the concept of individuality. This relates to the idea of building one's self with the moral values while developing psychologically.
- One should have a lot of patience and interest. One should adhere to the basic principles of humanity and should be strict with the Don'ts he has in mind and liberal with his Do's. The kindness towards his fellow beings is also an important concept to be kept in mind.
- A Person must have adequate knowledge and understanding about the use of ethical language to defend or support his views with others. He must have better knowledge in understanding the importance of suggestions and better solutions while resolving moral problems and the importance of tolerance on some critical situations.
- One must understand the importance of maintaining moral honesty and should be liberal to understand the human behavior under certain circumstances.

4.6 KOHLBERG'S THEORY
      Lawrence Kohlberg was a professor at Harvard University during early 1970s and famous for his works on developmental psychology. He conducted many studies at Harvard's Center for Moral Development and proposed a theory on moral development popularly known as Kohlberg's theory. His theory of moral development was dependent on the thinking of the Swiss psychologist Jean Piaget and the American

philosopher John Dewey. These men had emphasized that human beings develop philosophically and psychologically in a progressive fashion.

Kohlberg proposed that people progress in moral reasoning based on their ethical behavior. He postulated this theory based on the thinking of younger children throughout their growing period as adults. He conveyed that younger children make judgment based on the consequences occur and the older children make judgment based on their intuitions. He believed that there are six stages of moral development further classified into three levels.
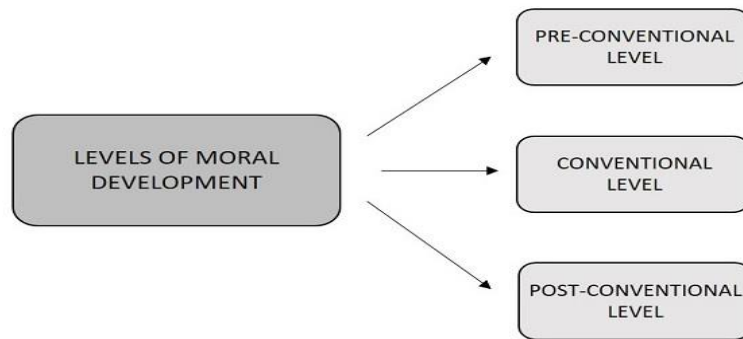
Fig 4.2 Lawrence Kohlberg Theory
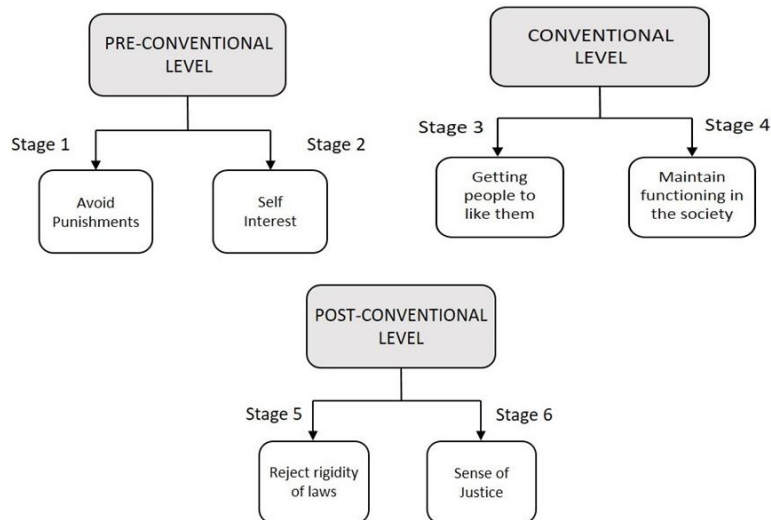
Fig 4.3 Levels of Moral Development

4.6.1 Preconventional Level

This is the first level of moral thinking generally found at Elementary school level. The thinker at this stage tends to think and behave based on the direct consequences that might occur.

- *Avoid Punishments*: A thinker at this stage generally thinks and believes that judgment to be made as per socially acceptable norms said by some higher official (teacher or a parent).
- *Self Interest:* A thinker at this stage, shows interest in making decisions according to the rewards they get in exchange.

4.6.2 Conventional Level

This is the second level of moral thinking generally found at the primary and high school level. The thinker at this stage tends to think and behave based on the want to please others.

- *Getting People to like them*: Here the protagonist behaves on account of the moral grounds which people decide for decision making. This decision may or may not support the law.
- *Maintain Functioning in Society*: The moral grounds on how people in the society will consider the job done will be the priority and a social order is maintained by abiding by the rules.

4.6.3 Post Conventional Level

This is the third level of Moral thinking generally found after the high school level. The thinker at this stage tends to think and behave based on a sense of justice.

- *Reject Rigidity of Laws*: The thinker uses his moral thinking skills at a commendable pace. He starts to feel for the protagonist based on moral grounds. The thinker rejects the rigidity of the existing laws and rules at this stage.
- *Sense of Justice*: The thinker feels a sense of justice for the protagonist. The thinker has great moral values free from the external factors that might influence his thinking process.

4.7 GILLIGAN'S THEORY

This is an advancement of Kohlberg's theory. It was proposed based on the moral thinking of privileged white men and boys. Hence this theory was popularized by taking both male and female thinking capabilities into account. Carol Gilligan, a psychological theorist pursued her doctorate degree in Social Psychology from the Harvard University. Gilligan was a research assistant for Lawrence Kohlberg, but she eventually became independent and criticized some of his theories.

Carol Gilligan opines that Kohlberg's theories are biased upon the male thinking process. According to Gilligan, Kohlberg seemed to have studied only privileged men and boys. She believed that women face a lot of psychological challenges and they are not moral widgets. Hence she proposed a theory which has the same three stages of Kohlberg but with different stages of moral development.
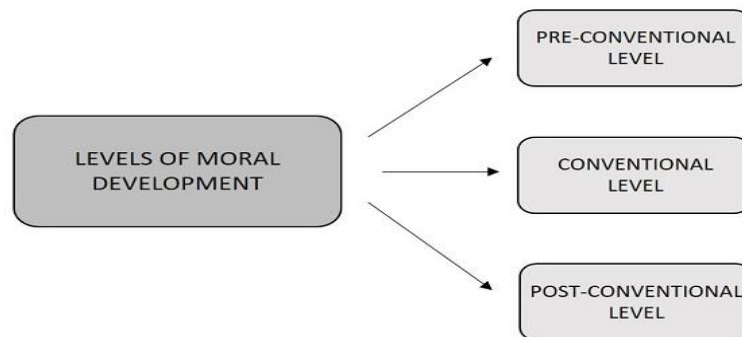

Fig 4.4. Gilligan's Theory

4.7.1 Three Levels of Moral Development

Pre-conventional Level:

A person in this stage cares for oneself to ensure survival. This is the transition phase, where the person finds the connection between oneself and others.

Conventional Level:

The person feels responsible and shows care towards other people. This moral thinking can be identified in the role of a mother and a wife. This sometimes leads to the ignorance of the self.

Post-conventional Level

The principle of care for self as well as others, is accepted. However, a section of people may never reach this level. According to Gilligan's theory of moral development, changes occur due to change of self rather than the critical thinking. The post-conventional level of Kohlberg is not attained by women.

4.7.2 Levels of Thinking

Gilligan states that the post-conventional level of moral thinking can be dealt based on the two types of thinking. Gilligan's theory is based on the two main ideas, the care-based morality (usually found in women) and the justice-based morality (usually found in men).

Care Based Morality for Women:

- More emphasis given to inter-connected relationships and universality.
- Acting justly focuses on avoidance of violence.
- Women with this are usually interested in helping others.
- More common in girls because of their connections to their mothers.
- Because girls remain connected to their mothers, they are less inclined to worry about issues of fairness.

Justice Based Morality for Men:

- They view the world as being composed of autonomous individuals who interact with one another.
- Acting justly means avoiding inequality.
- Individuals with this are usually interested in protecting individuality.
- Thought to be more common among boys because of their need to differentiate between themselves and their mothers.
- Because they are separated from their mothers, boys become more concerned with the concept of inequality.

4.7.3 Example for Gilligan'sTheory

A group of moles give shelter to a porcupine. But they are being continuously stabbed by the porcupine's quills. Now, what should they do?

- *Pre-conventional level*: To think for the good of oneself, either the moles or the porcupine only can live there.
- *Conventional level*: Brings a transition, from self to the good of others and which might even lead to sacrifice, either the moles or the porcupine has to sacrifice.
- *Post-conventional level*: The good of both the parties has to be considered, both the moles and the porcupine come to an agreement that both will have separate places in the same burrow and will not cause any trouble to other.

4.8 CONSENSUS AND CONTROVERSY

Consensus means 'agreement' and 'controversy' means disagreement. The consensus and the controversies are playing the vital roles while considering the moral autonomy. When an individual exercises the moral autonomy, he cannot get the same results as others get in applying moral autonomy. Surely there must be some moral

differences the results or verdicts will be of controversy. This kind of disagreements is unavoidable. These disagreements require some tolerances among individuals those who are autonomous, reasonable and responsible.

4.8.1 Consensus Vs Controversy

Consensus:

This is the state where people come into agreement with the judgment given by getting convinced with the moral reasons. This will leave the persons with a feel that justice has been done, the verdict may favor any party.

Controversy:

This is the state where the persons involved in an issue are not satisfied by the verdict and might feel that it was decided on partial interests. This will leave the people with a sense of dissatisfaction that justice was not done, which might lead to another conflict.

4.8.2 Goals of Engineering Ethics

The goal of teaching engineering ethics is not merely producing an agreed conformity on applying moral principles among engineers but reveal the ways of promoting tolerances to apply moral autonomy. Both the goals of engineering ethics and the goals of engineering courses have some similarities. These similarities have to be extended with the help of exercising authority. For example, in the class room, the teachers are having the authority over students and in the work place, the managers are having the authority over engineers

4.8.3 Autonomy Vs Authority

In short, conflicts will arise between autonomy and authority, when the authority is misused. For example, in small classes, the students are having the authority to express their own views. But when the professor doesn't allow them to do so, he misuses his authority. This will create some moral problems between the students and the faculty.

4.9 PROFESSION AND PROFESSIONALISM

4.9.1 Profession

Profession means a job or an occupation, that helps a person earn his living. The main criteria of a profession involves the following.

- *Advanced expertise*: The criteria of a profession is to have sound knowledge in both technical aspects and liberal arts as well.
- *Self-regulation*: An organization plays a major role in setting standards for the admission to the profession, drafting codes of ethics, enforcing the standards etc.
- *Public good*: Any occupation serves some public good by maintaining high ethical standards throughout a profession.

4.9.2 Professionals

A person who is paid for getting involved in a particular profession to earn a living as well as to satisfy the laws of that profession.

- Only consulting engineers who are basically independent and have freedom from coercion can be called as professionals." – By Robert L. Whitelaw
- "Professionals have to meet the expectations of clients and employers." – By Samuel Florman

- "Engineers are professionals when they attain standards of achievement in education, job performance or creativity in engineering and accept the most basic moral responsibilities to the public as well as employers, clients, colleagues and subordinates." – By Mike martin and Ronald Schinzinger

4.9.3 Models of Professional Engineers

- *Savior:* A person who saves someone from any danger is called a Savior. An engineer who saves a group of people or a company from a technical danger also be called a Savior.
- *Guardian*: A person who knows the direction towards a better future is known to be the Guardian. An engineer who knows the scope of direction for the technology to develop can also be called a Guardian.
- *Bureaucratic Servant*: An engineer can be a loyal person to the organization and also solves the technical problems the company encounters, using his special skills can be termed as a Bureaucratic servant.
- *Social Servant*: An engineer who receives a task as part of the government's concern for the society considering the directives laid by the society and accomplishes the assigned tasks can be termed as a Social Servant.
- *Social Enabler or Catalyst*: An engineer who plays a vital role in a company and helps company along with society to understand their needs and supports their decisions in work can be termed as a Social Enabler or Catalyst.
- *Game Player*: An engineer who acts as neither a servant nor a master, but provides his services and plans his works according to the economic game rules in a given time, can be termed as a Game player.

4.9.4 Professionalism

The art of Professionalism can be a practice of doing the right thing, not because how one feels but regardless of how one feels. Professionals make a profession of the specific kind of activity and conduct to which they commit themselves and to which they can be expected to conform. Moral ideals specify virtue, i.e., desirable feature of character. Virtues are desirable ways of relating to other individuals, groups and organizations. Virtues involve motives, attitudes and emotions.

4.10 PROFESSIONAL IDEAS AND VIRTUES

The virtues represent excellence in core moral behavior. The essentials for any professional to excel in the profession are behavior, skills and knowledge. The moral ideals specify the virtue, i.e., the desirable character traits that talk a lot about the motives, attitude and emotions of an individual.

- Public spirited virtues
- Proficiency virtues
- Team work virtues
- Self-governance virtues

The virtues mentioned above show the professional responsibility of an individual.

4.10.1 Public Spirited Virtues

The code of professional conduct in the field of engineering includes avoiding harm and protecting, as well promoting the public safety, health and welfare. Maintaining a sense of community with faith and hope within the society and extending time, talent and money to professional societies and communities, an engineer can

maintain the public-spirited virtue. Finally, justice within corporations, government and economic practices becomes an essential virtue that an engineer should always possess.

4.10.2 Proficiency Virtues

These refer to the virtues followed in the profession according to the talent and intellect of an engineer. The moral values that include this virtue are competence and diligence. The competence is being successful in the job being done and the diligence is taking care and having alertness to dangers in the job. Creativity should also be present in accomplishing the assigned task.

4.10.3 Teamwork Virtues

These virtues represent the coordination among team members which means working successfully with other professionals. These include cooperative nature along with loyalty and respect towards their organization, which makes the engineers motivate the team professionals to work towards their valuable goals.

4.10.4 Self Governance Virtues

These virtues are concerned with moral responsibilities which represent integrity and self-respect of the person. The integrity actually means the moral integrity which refers to the actions, attitude and emotions of the person concerned during his professional period. The self-governance virtues center on commitment, courage, self-discipline, perseverance, self-respect and integrity. The truthfulness and trustworthiness which represent his honesty are the crucial moral values to be kept up by a professional.

4.11 THEORIES ABOUT RIGHT ACTION (ETHICAL THEORIES)

An engineer with ethics is a person expected to possess the moral integrity with rich ethical values. The ethics are mainly divided into two categories depending upon the morality of humanity. They are −

- *Consequential Ethics*: Values the outcome of which determine the morality behind a particular action. A lie which saves a life, comes under this.
- *Non-consequential Ethics*: Values followed where the source of morality comes from the standard values. The moral law which states that a lie is a lie, and shouldn't be done, though it ends in a good deed.

Depending upon the ethics a person is intended to follow, four theories were postulated by four different philosophers as shown in Figure 4.5. These theories help to create the fundamentals of obligation suitable and applicable to professional and personal conduct of a person in his everyday life.

Fig 4.5 Types of Ethical Theories

4.11.1 Golden Mean Theory

According to this, the solution to a problem is found by analyzing the reason and the logic. A "Mean value of solution" will be between the extremes of excess and deficiency. For example, the solution to the problem of environment pollution is neither by avoiding industrialization and civilization, nor by neglecting the environment completely. A mean solution that will work towards controlling the pollution and protecting the environment will also help.

Problem in Application: The application of this theory varies from one person to another with their powers of reasoning and the difficulty in applying the theory to ethical problems.

4.11.2 Right Based Ethical Theory

According to this theory, the solution to a problem is by realizing that every person has a right to live. Live and let live is the philosophy behind this theory. The rights of a person towards life, health, liberty, possession, etc. are taken care of under this theory. For example, any action in terms of Capital punishment, Jails, Income taxes and Medical charges etc. come under this category.

Problem in Application: One rights of a person may be in conflict with rights of the other.

4.11.3 Duty Based Ethical Theory

The duty-based ethical theory was proposed by Immanuel Kant. According to this theory, every person has a duty to follow which is accepted universally, with no exceptions. An example of this can be expecting all to be honest, kind, generous and peaceful.

Problem in Application: The universal application of this theory can be misleading.

4.11.4 Utilitarian Ethical Theory

According to this theory, the happiness of a greatest number of people in the society is considered as the greatest good. According to this, an action is right if its consequences lead to happiness of people and wrong if they lead to their unhappiness. Example of this can be the removal of reservation system in education and government jobs, which can really benefit the talented.

Problem of Application: Qualification of the benefits can be difficult.

4.11.5 Types of Utilitarianism

The Act Utilitarianism states that "A particular action is right if it is likely to produce the higher level of good for the most people in a given situation, compared to alternative choices that might be made."

The Rule Utilitarianism states that "Right actions are those required by rules that produce the higher level of good for the most people."

4.11.6 Categorical Imperative Law

The categorical imperative law states that "Act only according to that maxim by which you can at the same time will that it should become a universal law." There are four virtues that come under this law -

- *Prudence*: Every individual has a life that should be respected and every individual has duties which should be done without any exception.
- *Temperance:* It is the voluntary self-restrain from the attractions.
- *Fortitude*: Fortitude is the sense of having tolerance.
- *Justice*: Every individual is a human being with a set of intrinsic values and morals.

4.12. USES OF ETHICAL THEORIES
4.12.1 Formulation of Ethical Theories
The ethical theories have to be formulated considering the following points −
- The concepts of the theory formulated must be coherent.
- The tenets of the theory should never contradict the other.
- The theory should never be defended upon false information.
- The theory should guide in specific situations comprehending all aspects possible.
- The theory should be compatible with individual's moral convictions in any situation.

4.12.2 Uses of Ethical Theories
Ethical theories help in the following areas −
- Understanding moral dilemmas.
- Justifying professional obligations and ideas.
- Relating ordinary and professional morality.

4.13 SELF INTEREST, CUSTOMS AND RELIGION
4.13.1 Self Interest
Self-interest is nothing but one's personal good. It refers to the goodness of oneself in the long run. Each of the ethical theories recognizes the importance of self-respect. Utilitarian considers one's own good as well as the good of others. Duty ethicists stresses duties to ourselves and for won well-being. Ethicists of rights emphasize our rights to pursue our own good. Virtue ethicists accent the importance of self – respect. The pursuit of self –interest must be balanced and kept under control by moral responsibilities to other people.

Let us consider a view called "ethical Egoism" which challenges all the ethical theories and it tries to reduce morality to the pursuit of self-interest. It is called 'egoism', because it says that the main duty of us is to maximize our own good. According to Thomas Hobbes and Any Rand, moral values are reduced to concern for oneself but always a rational concern which requires consideration of a person's long-term interests

4.13.2 Customs
As we live in a society of increasingly diverse nature, it is more important to have tolerance for various customs and outlooks. Hence the concept of ethical pluralism emerges. There may be alternative moral attitudes that are reasonable. But none of the moral perspectives can be accepted completely by all the rational and the morally concerned persons.

Ethical pluralism allows the customs which plays an important role in deciding how we should act. Moral values are many, varied and flexible. These moral values allow considerable variation in how different individuals and groups understand and apply them in their day-today activities.

Ethical Relativism, an objectionable view, should not be confused with Ethical Pluralism. The actions are morally right when they are approved by law or custom and they are said to be wrong when they violate laws or customs. Ethical relativism tries to

reduce moral values to laws, conventions and customs of societies. There are many reasons for accepting ethical relativism –

- The laws and customs seem to be definite, real and clear–cut. They help to reduce the endless disputes about right and wrong.
- The second reason for accepting ethical relativism is because it believes the values are subjective at the cultural level.
- They also state that the moral standards are varied from one culture to another

4.13.3 Religion

Moral responsibilities and religious belief are intertwined in many positive ways. First, they are related historically. Our moral views have been shaped by the most known central moral values within the major world religions. For example, the Judeo- Christian tradition has been influential in Western countries like England, USA etc. Islam has been having a great influence in middle east countries such as Saudi Arabia, Kuwait, Pakistan etc. Confucianism has been influential in China and Buddhism, Hinduism and Taoism have been famous in Asian countries.

Second, most of the people still having beliefs and show some important and inevitable psychological connections between their moral and religious beliefs. Religious views frequently support moral responsibility by providing additional motivation for being moral. The main social functions of religion is motivating right action based on ethical principles. Religion supports many people to follow their beliefs and promote tolerance and moral concern for others. Many of the engineers are motivated by the religious beliefs.

4.14 MODEL QUESTIONS

Part - A

1. What is engineering ethics?
2. What are the various issues faced by an engineer?
3. What is moral issue?
4. Give the types of moral issues.
5. What are the types of inquiries?
6. What is factual inquiry?
7. Mention the types of complexities.
8. Give the steps for facing moral dilemmas.
9. What is moral autonomy?
10. Give the skills required for improving the moral autonomy.
11. What is Kohlberg's theory for moral development?
12. What is Gilligan's theory for moral development?
13. What are the types of Level thingking?
14. Compare Consensus and Controversy.
15. Compare Autonomy with Authority.
16. What is professionalism?
17. Give the types of Virtues.
18. What are the types of ethical theories?
19. Mention the uses of ethical theories.
20. What is self-interest?

Part – B

1. Explain in brief, the senses of Engineering ethics and the types of Moral issues.
2. Write short notes on – (i) Moral Dilemmas (ii) Moral Autonomy.
3. Describe briefly the theories of Kohlberg and Gilligan with relevant examples.
4. Explaion in detail, the concept of Profession, Professionalism, professional ideas and virtues with suitable examples.
5. Explain the various types of Ethical thoeries used for right action.
6. Write short notes on – (i) Self Interest, Custom & Religion (i) Consensus and Controversy.

Unit V
ENGINEER'S RESPONSIBILITY FOR SAFETY

5.1 SAFETY AND RISK
5.1.1 Introduction

The responsible engineers follow the codes of ethics to avoid unnecessary problems. The problem occur in two different ways. One of them is when it can be assessed and the other is when it cannot be assessed. A mistake made by an engineer at work may result in huge losses.

An engineer is supposed to assess the risks of his experiments. The disasters do occur at times, though enough care is taken. But knowing all the possibilities, if an engineer neglects the precautions, the results can be really disastrous. So, the importance of safety should be anlyzed in the field of engineering.

The terms of safety and risk are inter-related. It is amazing to know that what may be safe enough for one person may not be for someone else. It is because of different perceptions about what is safe to them.

5.1.2 Safety

According to William W Lowrance, the famous consultant of those times, Safety was defined as "**A thing is safe if its risks are judged to be acceptable**." Let us consider three cases.

(i) First Case: Here the risks of something is underestimated. Buying a non-brand electric dryer from a local market without any guarantee, may eventually send one to a hospital with a severe electric shock or burn. While buying this dryer, according to Lowrance definition, this is quite safe, as the risks are judged to be acceptable.

(ii) Second Case: Here the risks of something is overestimated. If suddenly come to know that the consumption of carbonated beverages like cola are the cause of cancer for 5% of the world's cancer patients, then one start worrying considering Cola as a poisonous drink. So according to Lowrance definition, the Cola becomes unsafe the moment we judged the risks of using it to be unacceptable for us.

Fig 5.1 Safety First

(iii) Third Case: Here a group makes no judgment at all about whether the risks of a thing are acceptable or not. As defined by Lowrance, this is the position where the thing is neither safe nor unsafe with respect to that group. Just like using the products of certain brands are considered safe, while others are not where nothing seems to differ.

Safety is frequently expressed in terms of degree and comparisons. The words like **fairly-safe** and **relatively-safe** are used where an individual is judged on the basis of settled values and the risks of anything are more or less acceptable in comparison

with the risks of the other thing. For example, the consideration that road travel is safer than air-travel.

5.1.3 Risk

Any work which might lead to harm and not considered safe, can be understood as a risk. According to a popular definition, "**A risk is the potential that something unwanted and harmful may occur**." According to William D Rowe, **potential for the realization of unwanted consequences from impending events**.

Risk is a broad concept covering many different types of unwanted occurrences. When it comes to technology, it can equally well include dangers of bodily harm, of economic loss or of environmental degradation. These in turn can be caused by delayed job completion, faulty products or systems or economically or environmentally injurious solutions to technological problems.

Fig 5.2 Symbol for Danger

With the advancement in technology, people are now aware of all that goes into a process. Further, risks are understood as those that can be identified. Overall, the public perception has also undergone a change.

5.2 ASSESSMENT OF SAFETY
5.2.1 Introduction

A safety assessment is a systematic investigation and analysis of all health and safety risks associated with major incident hazards and major incidents. It demonstrates how those risks will be reduced as reasonably practicable. Any deficiency in the safety assessment process may make it difficult to demonstrate and that risk has been reduced so far as reasonably practicable.

A safety assessment generally follows the hazard identification process although some duplication between the two processes may be necessary. Hazard identification determines the hazards and causes of major incidents and starts to identify the range of controls that provide protection against a major incident occurring. Knowledge of hazards and their consequences is necessary for the safety assessment and improves decision making and seeks to reduce risk so far as reasonably practicable.

A systematic safety assessment employs a logical, transparent and repeatable process. This enables the operator to compare the range of incidents and identify which are the key contributors to the overall risk profile.

5.2.3 Steps for Safety Assessment

S.No	Steps	Considerations
1	Prepare Facility Description To Establish Context	• Include routine and non-routine activities, on and off-site hazards. • Linkages between the facility description and hazard identification.
2	Gather Input Data	• Facility design standards. • Incident reports from facilities. • Up-to-date facility drawings, plans and maps. • Existing studies • Data on specified hazardous substances.
3	Select Hazard Identification Technique	• Appropriateness of hazard identification techniques.
4	Establish Hazard Identification Team & Competency	• Composition of the hazard identification team, worker engagement and participation. • Competency and independence of the facilitator.
5	Determine Hazard Identification Timing	• Appropriateness of hazard identification timing. • Sufficient time allocation for hazard identification. • Availability of team members.
6	Conduct Assessment	• Presentation tools, format of meetings, worker involvement. • Method of documenting the safety assessment.
7	Documentation	• Capturing all hazard identification actions. • Documentation of discarded hazard identification scenarios. • Activities and decisions are traceable and reproducible. • Documentation and recording process of the sessions
8	Track Remedial Actions	• Method for tracking and closure of remedial actions and committed further actions.
9	Update Hazard Register	• Compiling findings into a register
10	Monitor And Review	• Revise safety assessment as necessary.

5.3 ASSESSMENT OF RISK
5.3.1 Definition of Risk Assessment
The definition of a risk assessment is a systematic process of identifying hazards and evaluating any associated risks within a workplace, then implementing reasonable control measures to remove them.

When completing a risk assessment, the following keywords are important:
- An **accident** is 'an unplanned event that results in loss'
- A **hazard** is 'something that has the potential to cause harm'

- A **risk** is 'the likelihood and the severity of a negative occurrence (injury, ill-health, damage, loss) resulting from a hazard.'

5.3.2 Different types of Risk Assessments

The types of risk assessment required within any workplace should be proportionate and relevant to the operational activities being undertaken. In many industries, there are specific legislative requirements that apply. Some common types of risk assessments include:

- Fire Risk Assessments: To be established in all workplaces including a suitable and sufficient fire risk assessment.
- Manual Handling Risk Assessment : To be conducted in any workplace where an employee may be at risk from injury or ill-health through the need to lift, carry, move loads.
- Display Screen Equiipment Risk Assessment: To be completed in workplaces where employees are using computers, laptops, etc.
- COSHH Risk Assessment: Required within workplaces where hazardous substances are used or manufactured.

A business may also choose to complete a Risk Assessment Method Statement (RAMS) dependent upon the nature of the operations being carried out. This process contains details of the hazard and a step-by-step procedure on how to complete work and control the risks identified.

5.3.3 Importance of Risk Assessments

Risk assessment is a straightforward and structured method of ensuring the risks to the health, safety and wellbeing of employees.

The main purpose of risk assessments are:

- To identify health and safety hazards and evaluate the risks presented within the workplace
- To evaluate the effectiveness and suitability of existing control measures
- To ensure additional controls are implemented wherever the remaining risk is considered to be anything other than low.
- To prioritise further resources if needed to ensure the above.

It can be a costly lesson for a business if they fail to have necessary controls in place. They could face not only financial loss but also loss in respect of production time, damage to equipment, time to train replacement employees and negative publicity amongst others.

5.3.4 Time to carry out Risk Assessment

A suitable and sufficient risk assessment must be carried out prior to a particular activity being carried out to eliminate, reduce or suitably control any associated risk to the health, safety and wellbeing of persons involved with the task in question. Once completed a risk assessment should be reviewed periodically and in any case when either the current assessment is no longer valid or if at any stage there has been significant changes to the specific activity. Relevant risk assessments should be reviewed following an accident, incident or ill-health event in order to verify if the control measures and level of evaluated risk where appropriate or require amendment.

5.3.5 Procdure for Risk Assessment

The HSE has recommended a five-step process for completing a risk assessment. It involves:

- Identifying potential hazards
- Identifying who might be harmed by those hazards
- Evaluating risk and establishing suitable precautions
- Implementing controls and recording your findings
- Reviewing the assessment and re-assessing if necessary.

Step 1. Identify potential hazards:

It is important to identify any potential hazards within a workplace that cause harm to anyone that comes into contact with them. The simple steps to identify hazards are:

- Walking around the workplace and looking at what activities, tasks could harm your employees.
- Looking back over past accidents, ill-health records, checking manufacturers' data sheets etc.
- Consulting with employees who are carrying out the activities, tasks or processes.

It may be useful to group hazards into five categories, namely physical, chemical, biological, ergonomic and psychological.

Step 2. Identify who might be harmed by those hazards

It should also be noted how they could be affected through direct contact or indirect contact. It is not necessary to list people by name, rather by identifying groups including – Employees and Contractors.

Step 3. Evaluate risk severity and establish precautions

After identifying any hazards it is important to evaluate the severity the risk may present and establish suitable and effective controls to reduce this level of risk as far as 'reasonably practicable'. Everything possible is done to ensure health and safety considering all relevant factors including:

- Likelihood that harm may occur
- Severity of harm that may occur
- Knowledge about eliminating, reducing or controlling hazards and risks
- Availability of control measures to eliminate, reduce or suitably control the risk
- Costs associated with above available control measures

Step 4. Implement changes and record findings:

If a workplace has five or more individuals, significate findings of the risk assessments are required to be kept either electronically or in writing. The risk assessment form is an easy way to keep track of the risks and control measures to reduce the identified risk.

Step 5. Review the assessment and reassess if necessary:

Employers should periodically review the assessment and if necessary, re-assess any controls in place. A good guide when you may need to review your processes are:

- After any significant change within the workplace or process in question
- After an accident or ill-health incident has occurred
- After near-misses have been reported.

5.3.6 Documentation for Risk Assessment

It is a misconception that risk assessments involve a vast amount of paperwork. It is nothing but completing a basic risk assessment form for many generic tasks or activities. However, employers should make sure they record significant findings including:

- What hazards were found
- Person(s) or groups affected

- The controls put in place to manage risks and who is monitoring them
- Who carried out the assessment
- On what date the assessment was done.

5.4 RISK BENEFIT ANALYSIS
5.4.1 Risk Analysis
The study of risk analysis covers other areas such as risk identification, risk analysis, risk assessment, risk rating, suggestions on risk control and risk mitigation. In fact, risk analysis can be deeply discussed with a view on risk management study. The risk management study also includes residual risk transfer, risk financing, etc.

A step-wise risk analysis includes −
- Hazards identification
- Failure modes and frequencies evaluation from established sources and best practices.
- Selection of credible scenarios and risks.
- Fault and event trees for various scenarios.
- Consequences-effect calculations with work out from models.
- Individual and societal risks.
- ISO risk contours superimposed on layouts for various scenarios.
- Probability and frequency analysis.
- Established risk criteria of countries, bodies, standards.
- Comparison of risk against defined risk criteria.
- Identification of risk beyond the location boundary, if any.
- Risk mitigation measures.

All of these again depend on how the risk is compared with the benefit in doing the work with some risk. How far it is beneficial to risk also counts the actions of a person while coming out of the safety bounds.

5.4.2 Risk Benefit Analysis
As per the famous saying, "A Ship in harbor is safe. But that's not what ships are built for" risk is somewhat common to be accepted. The most common risk people take is driving an automobile in a traffic. Though we are not sure about the perfect functionality of the brake system and the timings of other drivers' responses, we take risk. The controlling factor appears to be their perception of their individual ability to manage the risk-creating situation.

Fig 5.3 Vehicular Traffic

Just like the above instance, people mostly calculate the ratios of risk to benefit, while accepting the risks. The risk to benefit analysis is made depending on the types such as the ones mentioned below.

- The risk to be occurred in future is completely known after it gets fully developed. It is called as **Real future risk**.
- If the idea of risk is developed using current data, such one is called as **Statistical risk**.
- The risk which is analytically based on system models structured from historical studies is called as **Projected risk**.
- The risk which is intuitively seen by individuals is called as **Perceived risk**.

If risks of traveling on an air-plane is considered for observation, then the flight insurance. company can observe it as a statistical risk, while the risk the passenger faces is Perceived Risk and the Federal aviation administration, faces a Projected risk. Hence, the view of accepting the risk and the idea of risk to benefit ratio motivates the individual.

5.5 RISK REDUCTION
5.5.1 Risk Analysis
The study of risk analysis covers other areas such as risk identification, risk analysis, risk assessment, risk rating, suggestions on risk control and risk mitigation. In fact, risk analysis can be deeply discussed with a view on risk management study. The risk management study also includes residual risk transfer, risk financing, etc.

A step-wise risk analysis includes −
- Hazards identification
- Failure modes and frequencies evaluation from established sources and best practices.
- Selection of credible scenarios and risks.
- Fault and event trees for various scenarios.
- Consequences-effect calculations with work out from models.
- Individual and societal risks.
- ISO risk contours superimposed on layouts for various scenarios.
- Probability and frequency analysis.
- Established risk criteria of countries, bodies, standards.
- Comparison of risk against defined risk criteria.
- Identification of risk beyond the location boundary, if any.
- Risk mitigation measures.

All of these again depend on how the risk is compared with the benefit in doing the work with some risk. How far it is beneficial to risk also counts the actions of a person while coming out of the safety bounds.

5.5.2 Steps for Risk Reduction
The risks generally faced can be reduced to a great extent by proper analysis with steps. as mentioned below −
- Define the Problem.
- Generate Several Solutions.
- Analyze each solution to determine the pros and cons of each.
- Test the solutions.
- Select the best solution.
- Implement the chosen solution.

- Analyze the risk in the chosen solution.
- Try to solve or move to next solution.

5.6 THE CHERNOBYL'S CASE STUDY
5.6.1 Introduction
The Chernobyl disaster was nuclear accident that occurred at **Chernobyl Nuclear Power Plant** on April 26, 1986. Chernobyl nuclear reactor plant, built at the banks of **Pripyat** river of **Ukraine**, had four reactors, each capable of producing 1,000 MWs of electric power. On the evening of **April 25th 1986**, a group of engineers, planned an electrical engineering experiment on the Number 4 Reactor. With their little knowledge on Nuclear physics, they thought of experimenting how long turbines would spin and supply power to the main circulating pumps following a loss of main electrical power supply.

Fig 5.4 Chernobyl Nuclear Power Plant

5.6.2 Reasons for Disaster
The reactor unit 4 was to be shut down for routine maintenance on 25 April 1986. But, it was decided to determine whether, in the event of a loss of station power, the slowing turbine could provide enough electrical power to operate the main core cooling water circulating pumps, until the diesel emergency power supply became operative. The aim of this test was to determine **whether cooling of the core could continue in the event of a loss of power**.

Due to the misconception that this experiment belongs to the non-nuclear part of the power plant, it was carried out without a proper exchange of information between the testing department and the safety department. Hence the test started with inadequate safety precautions and the operating personnel were not alerted to the nuclear safety implications of the electrical test and its potential danger.

5.6.3 The Experiment
Phase 1: According to the test planned, the **Emergency Core Cooling System** (ECCS) of the reactor, which provides water for cooling the reactor core, was shut down deliberately. The reactor has to be stabilized at about 700-1000 MW prior to shut down, but it fell down to 5000 MW due to some operational phenomenon. Later, the operator working in the night shift committed an error, by inserting the reactor control rods so far. This caused the reactor to go into a near-shutdown state, dropping the power output to around 30 MW.

Since this low power was not sufficient to make the test it was decided to restore the power by extracting the control rods, which made the power stabilize at 200 MW. This was a violation to safety law, due to the **positive void co-efficiency** of the reactor. The test was decided to be carried out at this power level.

Phase 2: At 1:23, on April 26th 1986, the engineers continued with their experiment and shut down the turbine engine. In fact, it did not adequately power the water pumps and without the cooling water the power level in the reactor got surged. The water pumps started pumping water at a slower rate and with the entry to the core of slightly warmer feed water, may have caused boiling at the bottom of the core. This, along with xenon burn out, might have increased the power level at the core. The power level was then increased to 530 MW and continued to rise. The fuel elements were ruptured and lead to steam generation resulting in high power output.

As a result, two explosions were reported. The first one was the initial steam explosion. Eventually, after two to three seconds, a second explosion took place, from the build-up of hydrogen due to zirconium-steam reactions. In the explosion and ensuing fire, more than 50 tons of radioactive material were released into the atmosphere, where it was carried by air currents. This was 400 times to the amount of radioactive materials released at the time of Hiroshima bombing.

5.6.4 Fatal Effects of the Disaster
The Chernobyl Nuclear Power Plant disaster is the only accident in the history of commercial nuclear power to cause fatalities from radiation. There were many fatal effects due to the radiation released.
- Two workers had died.
- 28 emergency workers and staff died within 4 months of the accident due to the thermal burns and the radiation effect on their bodies.
- This accident created 7,000 cases of thyroid cancer.
- Acute radiation syndrome (ARS) was diagnosed in 237 people, who were on-site and involved in cleaning up
- The land, air and ground water were all contaminated to a great extent.
- Exposure to radiation led to many severe health problems such as Downs Syndrome, Chromosomal Aberrations, Mutations, Leukemia, Thyroid Cancer and Congenital Malfunctions, etc.
- A number of plants and animal faced destruction as after-effect.

5.7 THE THREE MILE ISLAND CASE STUDY
5.7.1 Introduction
On March 28, 1979, there was a partial meltdown of the core in number 2 reactor at Three Mile Island Nuclear Generating Station (TMI-2) near Harrisburg, Pennsylvania. This incident remains the worst in the history of U.S. commercial nuclear power. No one was injured and there was no significant release of nuclear radiation, but there was the real potential for a major disaster. The accident also stoked concerns about the safety of nuclear power and led to a drop in public support for nuclear power.

5.7.2 Getting to the root of the problem
Like all accidents, a number of factors contributed to the accident at TMI-2. In order to understand what occurred at TM1-2, it is essential to know the basic plant design. TMI-2 had a closed primary loop where primary coolant was heated as it flowed through the reactor core and transferred heat through the steam generator to the secondary loop. The heat transferred to the secondary loop was then used to turn a turbine connected to a generator to produce electricity.
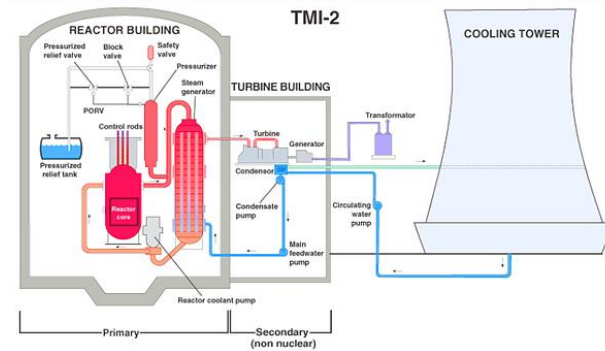
Fig 5.5 Layout of TMI 2

A Cause Map, an intuitive method for performing a root cause analysis can be built to visually layout the cause-and-effect relationships of the causes that contributed to the accident. The first step in Cause Mapping is to define the problem by filling in an Outline which includes listing the impacts to the organizational goals. The Cause Map is built by starting at one of the impacted goals and asking "why" questions.

5.7.3 Stuck Open Relief Valve

The accident began with failures in the secondary loop that resulted in a loss of feedwater to the secondary side of the steam generators, meaning that heat and pressure increased in the closed primary loop. The plant was designed to withstand a loss of feedwater, but an additional failure of a primary pressure relief valve magnified the problem. The pressure relief valve was designed to open when the primary plant pressure increased above a set limit. The relief valve lifted as a result of the increased pressure after the loss of feedwater failed to reseat as designed after pressure decreased. The valve remained open as coolant continued to flow out of it until a manual block valve was closed to isolate it.

5.7.4 Operators Unaware Valve Was Open

There was a block valve that could have been shut to stop the loss of coolant, but operators were unaware of the fact that the valve was stuck open. They did not take action to mitigate the situation until it was too late to prevent the partial meltdown of the core. The control room at the plant was huge and had hundreds of indications. When this incident occurred, operators received dozens of alarms, both audible and flashing lights, in a short period of time without any obvious priority.

In addition, operators had false indication that the pressure relief valve was closed. The indication actually showed the status of the solenoid that operated the pressure relief valve and only indicated whether the solenoid was powered or not, not whether the valve was actually closed. The solenoid was expected to close the valve, but the valve had failed to reseat so the light indicated that the pressure relief was closed when it was not.

Alarms continued throughout the incident and the sheer volume of information made it difficult to interpret the situation accurately. Moreover falsely led operators believed the valve was closed and an extremely high stressful environment took them so long to isolate the leaking pressure relief valve.

5.7.5 The Root Cause of the incident

Many people used to say the stuck open relief valve was the root cause of the Three Mile Island accident and it was certainly a major factor, but it doesn't tell the whole story. Identifying a single "root cause" is generally not helpful and tends to limit

the solutions considered. Building a cause map and identifying the system of causes that contributed to an incident helps investigators dig deeper and widens the solutions that are considered. For example, it is not only important to understand that the relief valve was stuck open, but to also understand why it took long time for operators to identify that it was open.

In opinion, the biggest lesson to be learned from Three Mile Island is that operators can only make decisions that are as good as the information and training they are given.

5.8 MODEL QUESTIONS
Part – A
1. What is safety?
2. What is risk?
3. What is safety assessment?
4. Give the definition for risk assessment.
5. Mention the various types of risk assessments.
6. What is the importance of risk assessment?
7. What is the procedure for risk assessment?
8. What is risk analysis?
9. Mention any four steps required for risk reduction.
10. What is the main reason for Chernobyl's disaster?
11. What is the root cause for Three mile island disaster?
12. What is called projected risk?
13. What is called statistical risk?

Part – B
1. Describe the various responsibilities of an Engineer with respect to Safety and Risk.
2. Explain the procedure of Assessment for both Safety and Risk.
3. Explain briefly, the methodology of Risk Benefit Analysis.
4. Write a short note on the Case study – The Chernobyl's Disaster.
5. Write a short note on the Case study – The Three Mile Island Disaster.

OUTCOMES:

- At the end of the course the student should be able to: Examine situations and to internalize the need for applying ethics principles, values to tackle with various situations.
- Develop a responsible attitude towards the use of computer as well as the technology.
- Able to envision the societal impact on the products / projects they develop in their career. Understanding the code of ethics and standards of computer professionals.
- Analyze the professional responsibility and empowering access to information in the work place.

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- Edmund G.See Bauer & Robert L.Bany, "Fundamental of Ethics for Scientists and Engineering", Oxford University