

Department	Mechanical		Program	B-tech	
Subject name	Industrial engineering II		Subject code	MEC 703	
Semester	VII	Credits	4	Teacher in charge	
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Unit 1

Links to resources:

1. <https://en.wikipedia.org/wiki/Factory>
2. <http://smallbusiness.chron.com/principles-organizational-structure-659.html>
3. <http://smallbusiness.chron.com/different-types-organizational-structure-723.html>
4. <http://www.yourarticlelibrary.com/organization/charts/organization-charts-types-principles-advantages-and-limitations/53238/>
5. https://en.wikipedia.org/wiki/Informal_organization
6. <http://www.businessmanagementideas.com/organisation/advantages-and-disadvantages-of-informal-organisations/2344>
7. <http://www.yourarticlelibrary.com/management/10-benefits-of-a-good-organizational-structure-explained/3508/>

Text books:

1. Everett, E.A., Ronald J.E, “Production and Operations Management” Prentice Hall of India, 5th edition, New Delhi, 2001.
2. S Anil Kumar and Suresh, “Production And Operations Management” New Age International Pvt. Ltd. Publishers.

Reference Books:

1. Claude, S.G., “Management for Business & Industry” Prentice Hall of India, New Delhi, 2000.
2. Everett, E.A., Ronald J.E, “Production and Operations Management”, Prentice Hall of India, 5 th Edition, New Delhi, 2001.
3. Grant, E.L; Leavenworth R.S, “Statistical Quality Control”, Tata McGraw Hill, 7th Edition, New Delhi, 1996. 4. Apple, J.M, “Plant Layout & Material Handling”, John Wiley & Sons, New York. 5. Maynard, Industrial Engineering Hand Book, McGraw Hill, New York.

Lecture Notes:

Lecture 1

Topics to be covered

Factory organization, Introduction to Plant organization, Principles of Organizational structure

1.1 Introduction:

Industrial Engineering (IE) is concerned with the design, improvement and installation of integrated systems of people, materials, information, equipment and energy. It draws upon specialized knowledge and skill in the mathematical, physical and social sciences together with the principles and methods of engineering analysis and design to specify predict and evaluate the results to be obtained from such systems.

1.2 Topic Name:

Factory Organisation:

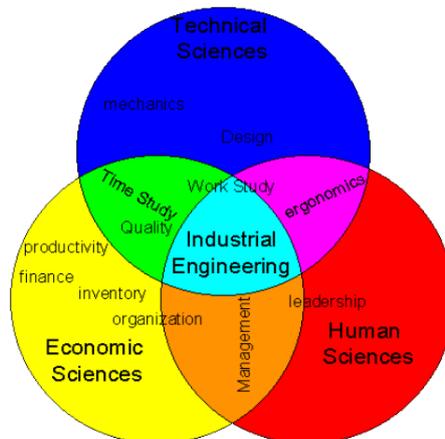


Fig 1. Academics domain of Industrial Engineering

A factory (previously manufactory) or manufacturing plant is an industrial site, usually consisting of buildings and machinery, or more commonly a complex having several buildings, where workers manufacture goods or operate machines processing one product into another.

Factories arose with the introduction of machinery during the Industrial Revolution when the capital and space requirements became too great for cottage industry or workshops. Early factories that contained small amounts of machinery, such as one or two spinning mules, and fewer than a dozen workers have been called glorified workshops.

1.3 Topic Name:

Principles of Organization Structure:

Organizational structure is the framework by which a company communicates, develops goals and then works on achieving those goals. Within the framework of organizational structure are the principles by which that structure operates. The principles of organizational structure are the methods by which the organization maintains that structure, and the processes it uses to keep the structure efficient.

1. Hierarchy of Command:

One of the principles that hold an organizational structure together is the hierarchy of command. Respect for the authority of management and the executive team creates a functional line of communication. Instructions and decrees given by the upper echelon are validated by the belief in the hierarchy structure of the organization. Everyone in the company can follow the trail of responsibility for projects, and employees understand who they report to and how the management structure affects their jobs

2. Role Definition:

According to the University of York in York, England, an efficient organizational structure helps to properly define everyone's role within the company. A clear definition of the responsibilities and standing of each person within the company creates an understanding of what is expected from each individual, and how individual performance can affect the efficiency of the entire organization.

3. Evaluating Outcomes:

The RAND Corporation points out that monitoring the outcome of individual projects, as well as the ongoing performance evaluation of individual employees, helps to determine the strengths and weaknesses in the organizational structure. The weaknesses can be dealt with either through training, reallocation of company assets such as equipment, or eliminating ineffective employees or those performing duplicate tasks. The strengths of the organization can be amplified to help identify future managers of the company, determine successful

processes that can be used in future projects, and improve the processes used to reach future company goals.

Altering Organizational Structure:

One of the key principles of organizational structure is the ability to remain dynamic and change to suit the needs of the company. Some of the elements that necessitate change in an organizational structure include changing customer needs, a change in company management, new technology, and reacting to the activities of your competition.

Lecture 2

1.4 Topic Name

Different types of Organization Structure:

Organizations are set up in specific ways to accomplish different goals, and the structure of an organization can help or hinder its progress toward accomplishing these goals. Organizations large and small can achieve higher sales and other profit by properly matching their needs with the structure they use to operate. There are three main types of organizational structure: functional, divisional and matrix structure.

1. Functional Structure

Functional structure is set up so that each portion of the organization is grouped according to its purpose. In this type of organization, for example, there may be a marketing department, a sales department and a production department. The functional structure works very well for small businesses in which each department can rely on the talent and knowledge of its workers and support itself. However, one of the drawbacks to a functional structure is that the coordination and communication between departments can be restricted by the organizational boundaries of having the various departments working separately.

2. Divisional Structure

Divisional structure typically is used in larger companies that operate in a wide geographic area or that have separate smaller organizations within the umbrella group to cover different types of products or market areas. For example, the now-defunct Tecumseh Products Company was organized divisionally--with a small engine division, a compressor division, a parts division and divisions for each geographic area to handle specific needs. The benefit of this structure is that needs can be met more rapidly and more specifically; however,

communication is inhibited because employees in different divisions are not working together. Divisional structure is costly because of its size and scope. Small businesses can use a divisional structure on a smaller scale, having different offices in different parts of the city, for example, or assigning different sales teams to handle different geographic areas.

3. Matrix

The third main type of organizational structure, called the matrix structure, is a hybrid of divisional and functional structure. Typically used in large multinational companies, the matrix structure allows for the benefits of functional and divisional structures to exist in one organization. This can create power struggles because most areas of the company will have a dual management--a functional manager and a product or divisional manager working at the same level and covering some of the same managerial territory.

1.5 Topic Name:

Organization Charts: Types, Principles, Advantages and Limitations

Organization chart is a diagrammatical presentation of relationships in an enterprise. The functions and their relationships, the channels of authority and relative authority of different managers etc. are depicted in an organizational chart. George Terry defines an organization chart as “a diagrammatical form which shows important aspects of an organization, including the major functions and their respective relationships, the channel of supervision and the relative authority of each employer who is in-charge of each respective function.” So a chart is pictorial and indicating functions and their relationship, clear lines of authority and responsibility, channels of communication and span of control and supervision.

Organization charts can be divided into:

- (i) Master charts and
- (ii) Supplementary charts.

The master chart shows the whole formal organizational structure while supplementary chart shows details of relationships, authority and duties within the prescribed area of a department.

Types of Organization Charts:

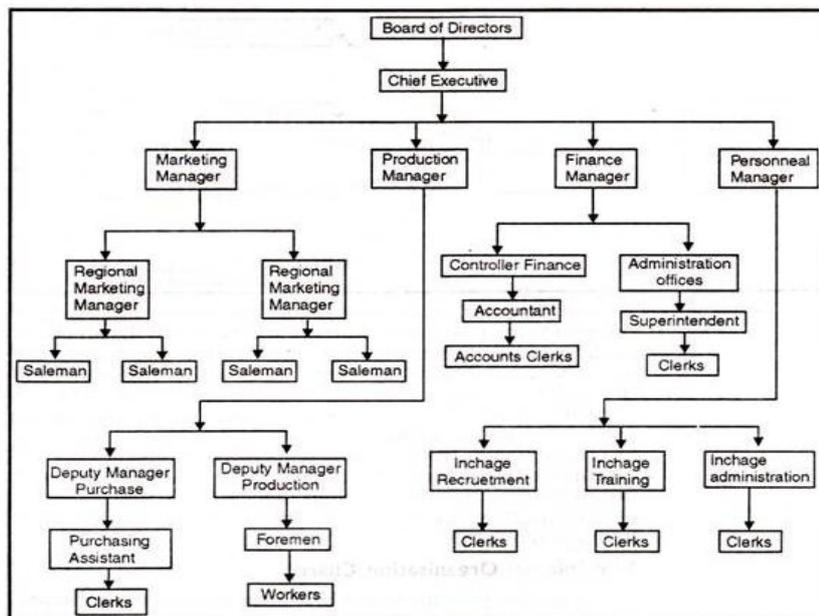
There are three ways in which organization charts can be shown:

- (i) Vertical
- (ii) Horizontal
- (iii) Circular

(i) Vertical or Top to Bottom:

In this chart major functions are shown at the top and subordinate functions in successive lower positions. In this chart scalar levels run horizontally and functions run vertically. The supreme authority is shown at the top while lowest authority at the bottom.

The vertical chart is shown in the following diagram. In this diagram Board of Directors is at the top of the organization. The chief executive controls various functional managers, who in turn have downward staff as the requirement of respective departments.

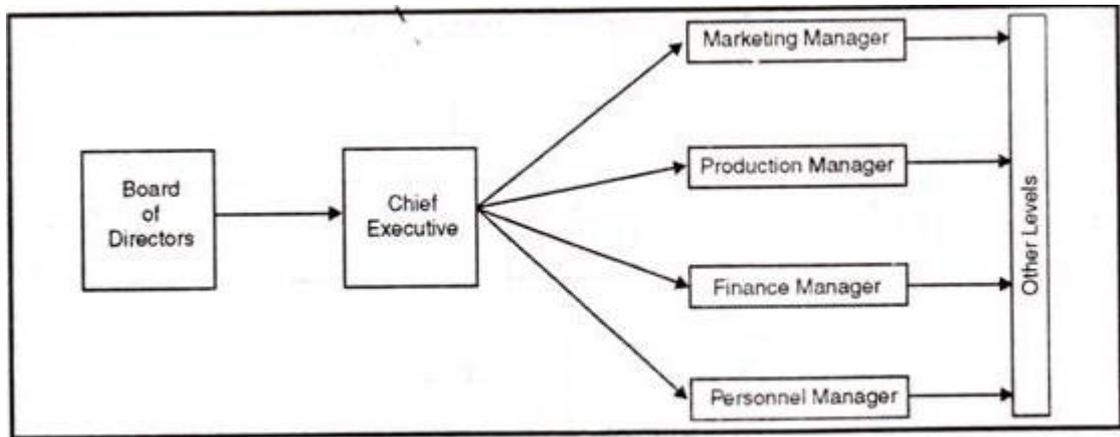


(ii) Horizontal or Left to Right:

In this chart highest positions are put on the left side and those with diminishing authority move towards the right. The organizational levels are represented by vertical columns, the flow of authority from higher to lower levels being represented by movement from left to right. In other words it presents scalar levels in a vertical position and functions horizontally.

The same levels of authority as shown in vertical chart can be depicted in a left to right chart as follows:

In horizontal chart the supreme authority Le. Board of Directors is shown on the left and chief executive and functional managers and other levels move towards right.



(iii) Circular:

In circular chart the centre of the circle represents the position of supreme authority and the functions radiate in all directions from the centre. The higher the positions of authority, the nearer they are to the centre and the lesser the positions of authority, more distant they are from the centre. The positions of relative equal importance are located at the same distance from the centre. The lines forming different blocks of functions or positions indicate the channels of formal authority, the same as in other arrangements. The circular chart depicts the actual condition of outward flow of formal authority from the Chief Executive in many directions.

Lecture 3

Principles of Organization Charts:

Following principles should be kept in mind while framing organization charts:

- (i) The top management should faithfully follow the line of authority while dealing with subordinates. Any attempt to buy pass the organization chart will make it meaningless.

- (ii) The chart should define lines of position. The lines of different individuals should be so defined so that there is no overlapping and no two persons should be given the same position.
- (iii) The undue concentration of duty at any point should be avoided.
- (iv) The organization chart should not be influenced by personalities. Balance of organization should be given more importance than the individuals.
- (v) The organization chart should be simple and flexible.

Advantages of Organization Charts:

1. An organization chart is a managerial tool. It helps in specifying authority and responsibility of every position. The relationships among different persons are also established for smooth working of the organization.
2. As organization chart specifically defines authority and responsibility of people in the enterprise there will be no duplication and overlapping of duties etc. Even if it happens in a particular instance it can be rectified immediately.
3. The organization chart will help in pointing out the faults, deficiencies, dual command etc. in the organization. The management will be able to take prompt remedial action in case of certain lacuna.
4. The organization chart acts as an information centre to the new entrants and they can easily understand different levels of authority and responsibility.
5. The charts are also helpful in decision-making process. They act as a guide to the decision makers.

Limitations of Organization Charts:

The organization charts suffer from the following drawbacks:

1. The organization charts show the relationship of different positions and not the degree of authority and responsibility. The size of boxes or circles in the chart cannot show the level of authority, etc.

2. A chart only depicts formal organizational relationship whereas informal organization is ignored. Practically informal organization is as useful as formal organization. Informal organization greatly helps management in knowing the reactions of the people and is an important channel of communication.

3. A chart shows organizational position and status at different levels. It gives rise to superior-inferior feeling among people and it retards the feeling of team work.

1.6 Topic Name:

Results of Good Organization

1. A good organizational structure facilitates attainment of objectives through proper coordination of all activities:

It has a built-in system of “checks and balances” so that the progress towards the attainment of objectives is evaluated along the way so that any required adjustments can be made and any new decisions required can be taken.

2. In a good organizational structure, the conflicts between individuals over jurisdiction are kept to a minimum:

Since each person is assigned a particular job to perform, the responsibility of performing that job rests solely with him. It results in traceability of outcomes and the work interdependency of that particular task is reduced to a minimum.

3. It eliminates overlapping and duplication of work:

Duplication exists when work distribution is not clearly identified and the work is performed in a haphazard and disorganized way. Since a good organizational structure requires that the duties be clearly defined and assigned, such duplication of work is eliminated.

4. It decreases likelihood of “run-arounds:”

The run-arounds occur when we do not know who is responsible for what and we are not sent to the right people in the first instance for getting some work done. However, in a well organized company where the responsibilities are clearly established, this does not occur.

5. It facilitates promotions of personnel:

Since the organizational chart clearly pinpoints the positions of individuals relative to one another, it is easier to know as to which level a person has reached at any given time in the organizational hierarchy. Furthermore since each job is well described in terms of qualifications and duties, the promotional stages can be more clearly established.

6. It aids in wage and salary administration:

A fair and equitable wage and salary schedule is based upon the premise that the jobs with similar requirements should have similar benefits. If these requirements are clearly established and the yearly increments or the cost of living increments for each type of job are properly and clearly understood, then compensation administration policies are easier to implement.

7. Communication is easier at all levels of organizational hierarchy:

Since the lines of communication and flow of authority are clearly identified on the organizational chart, the intercommunication is both clearer and easier and it eliminates ambiguity.

8. A well-structured organization provides a sound basis for effective planning:

Since the goals are clearly established and resources clearly identified, both short term as well as strategic planning becomes more focused and realistic and such planning contains the provision to permit changes to be made in the right direction including expansion and contraction of facilities, operations and activities when it becomes necessary.

9. It results in increased cooperation and a sense of pride among members of the organization:

An employee is given sufficient freedom within the domain of his responsibility and his authority. Since the authority and the extent of exercise of such authority is known, it develops a sense of independence among employees which in turn is highly morale boosting.

10. It encourages creativity:

Because of a sense of belonging and high morale that a well-structured organization develops among employees and also because of clear-cut accountability, recognition of skill and appreciation for their contribution towards organizational growth, the employees develop their own initiative and a spirit of innovation and creativity.

Lecture 4

1.7 Topic Name:

Informal Organization

The informal organization is the interlocking social structure that governs how people work together in practice. It is the aggregate of, norms, personal and professional connections through which work gets done and relationships are built among people who share a common organizational affiliation or cluster of affiliations. It consists of a dynamic set of personal relationships, social networks, communities of common interest, and emotional sources of motivation. The informal organization evolves, and the complex social dynamics of its members also.

Tended effectively, the informal organization complements the more explicit structures, plans, and processes of the formal organization: it can accelerate and enhance responses to unanticipated events, foster innovation, enable people to solve problems that require collaboration across boundaries, and create footpaths showing where the formal organization may someday need to pave a way.

Advantages and Disadvantages of Informal Organisations

Some of the advantages and disadvantages of informal organization are as follows:

Advantages of Informal Organisation:

1. Full fills Social Needs:

It meets social needs of the members and hence results in a sense of belongingness among them.

2. Influence on Productivity:

It has a powerful positive influence on the productivity and job satisfaction.

3. Fast Communication:

It serves as a faster channel of communication.

4. Full fills Organisational Objectives:

It helps in achieving organisational objectives by compensating the limitations of the formal structure.

Disadvantages of Informal Organisation:

Disadvantages of informal organisation are as follows:

1. Resistance to Change:

It is very difficult for management to bring changes in the organisation if the informal organisation opposes them. Such resistance may restrict growth of the organisation.

2. Creates Rumours:

Sometimes informal organisation becomes a disturbing force, which can go against organisational interests, e.g., spreading rumours in the organisation.

3. Lack of specialisation:

It is based on the mutual relationships rather than on division of work as anybody can talk to any person in any department with regard to any topic. Hence, specialisation is not possible.

Lecture 5

1.8 Topic Name:

Plant location and layout

Introduction and meaning

Plant location or the facilities location problem is an important strategic level decision-making for an organisation. One of the key features of a conversion process (manufacturing system) is the efficiency with which the products (services) are transferred to the customers. This fact will include the determination of where to place the plant or facility. The selection of location is a key-decision as large investment is made in building plant and machinery. It is not advisable or not possible to change the location very often. So an improper location of plant may lead to waste of all the investments made in building and machinery, equipment. Before a location for a plant is selected, long range forecasts should be made anticipating future needs of the company. The plant location should be based on the company's expansion plan and policy, diversification plan for the products, changing market conditions, the changing sources of raw materials and many other factors that influence the choice of the

location decision. The purpose of the location study is to find an optimum location one that will result in the greatest advantage to the organization.

Need For Selecting a Suitable Location

The need for selecting a suitable location arises because of three situations.

- I. When starting a new organisation, *i.e.*, location choice for the first time.
- II. In case of existing organisation.
- III. In case of Global Location.

In Case of Location Choice for the First Time or New Organisations

Cost economies are always important while selecting a location for the first time, but should keep in mind the cost of long-term business/organisational objectives. The following are the factors to be considered while selecting the location for the new organisations:

Identification of region

The organisational objectives along with the various long-term considerations about marketing, technology, internal organisational strengths and weaknesses, region specific resources and business environment, legal-governmental environment, social environment and geographical environment suggest a suitable region for locating the operations facility.

Choice of a site within a region

Once the suitable region is identified, the next step is choosing the best site from an available set. Choice of a site is less dependent on the organisation's long-term strategies. Evaluation of alternative sites for their tangible and intangible costs will resolve facilities-location problem. The problem of location of a site within the region can be approached with the following cost-oriented non-interactive model, *i.e.*, dimensional analysis.

Dimensional analysis

If all the costs were tangible and quantifiable, the comparison and selection of a site is easy. The location with the least cost is selected. In most of the cases intangible costs which are expressed in relative terms than in absolute terms. Their relative merits and demerits of sites can also be compared easily. Since both tangible and intangible costs need to be considered for a selection of a site, dimensional analysis is used. Dimensional analysis consists in computing the relative merits (cost ratio) for each of the cost items for two alternative sites. For each of the ratios an appropriate weightage by means of power is given and multiplying these weighted ratios to come up with a comprehensive figure on the relative merit of two alternative sites, *i.e.*

$$C_1^M, C_2^M, \dots, C_Z^M$$

M are the different costs associated with a site M on the 'z' different cost items.

$$C_1^N, C_2^N, \dots, C_Z^N$$

N are the different costs associated with a site N and $W_1, W_2, W_3, \dots, W_z$ are the weightage given to these cost items, then relative merit of the M and site N is given by:

$$\left(C_1^M / C_1^N \right)^{w_1} \times \left(C_2^M / C_2^N \right)^{w_2} \dots \dots \dots \left(C_z^M / C_z^N \right)^{w_z}$$

If this is > 1, site N is superior and vice-versa.

When starting a new factory, plant location decisions are very important because they have direct bearing on factors like, financial, employment and distribution patterns. In the long run, relocation of plant may even benefit the organization. But, the relocation of the plant involves stoppage of production, and also cost for shifting the facilities to a new location. In addition to these things, it will introduce some inconvenience in the normal functioning of the business. Hence, at the time of starting any industry, one should generate several alternate sites for locating the plant. After a critical analysis, the best site is to be selected for commissioning the plant. Location of warehouses and other facilities are also having direct bearing on the operational performance of organizations.

The existing firms will seek new locations in order to expand the capacity or to place the existing facilities. When the demand for product increases, it will give rise to following decisions:

- Whether to expand the existing capacity and facilities.
- Whether to look for new locations for additional facilities.
- Whether to close down existing facilities to take advantage of some new locations.