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III/IV B.Tech (Regular) DEGREE EXAMINATION**February, 2021****Mechanical Engineering****fifth Semester****INDUSTRIAL ENGINEERING AND MANAGEMENT****Time:** Three Hours**Maximum:** 50 Marks*Answer Question No.1 compulsorily.**(1X10 = 10 Marks)**Answer ONE question from each unit.**(4X10=40 Marks)*

1. Answer all questions

(1X10=10 Marks)

- a) Define Industrial Engineering.
- b) What is total productivity?
- c) Define Business Process Reengineering.
- d) List any two charts to record moments in shop operation.
- e) Describe SIMO chart.
- f) Define work measurement.
- g) Give an example of where the fixed position layout is used.
- h) What is partnership deed?
- i) List the levels of management.
- j) Give an example of digital marketing.

UNIT I

2. a) Write about the evolution and historical developments of Industrial Engineering. 5M
- b) Explain the measures to improve the productivity. 5M

(OR)

3. a) Describe the factors affecting the productivity. 5M
- b) Write and explain the Steps to implement Business Process Reengineering. 5M

UNIT II

4. Discuss in detail multiple activity chart with an example. 10M

(OR)

5. Write and explain the principles of motion economy 10M

UNIT III

6. a) Compare the rural and urban sites for plant location. 5M

- b) Distinguish between product and process layouts. 5M

(OR)

7. Describe the features, advantages and disadvantages of joint stock company type of business firm. 10M

UNIT IV

8. Describe the functions of management 10M

(OR)

9. Explain the product life cycle along with the marketing strategies adopted in each of the stage of PLC. 10M

Sub: INDUSTRIAL ENGINEERING AND MANAGEMENT [18ME505]

Scheme of valuation cum Solution set

1

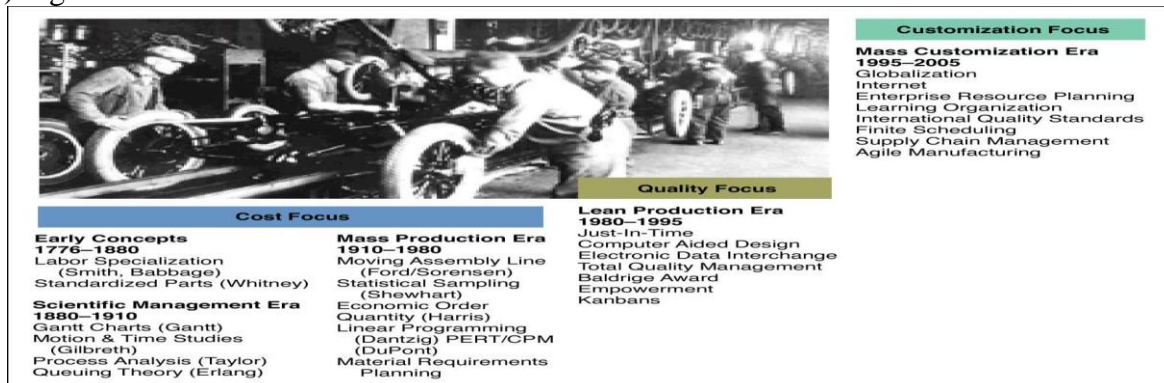
1 X 10 = 10 M

- a) Industrial Engineering is concerned with the design, improvement and installation of integrated systems of men, materials and equipment.
- b) It is the ratio between the output of goods and services and the input of resources consumed in the process of production.” Output implies total production while input means land, labour, capital, management, etc.
- c) Fundamental Rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measures of performance such as cost, quality service, job satisfaction, and speed.
- d) Operation process charts and flow process charts
- e) SIMO = SImultaneous MOtion Chart
 - Recording technique for Micro Motion study
 - Simultaneous motions are filmed and recorded on a common time scale and analyzed
- f) It is defined as the application of techniques designed to establish the work content of a specified task by determining the time required for carrying out the task at a defined standard of performance by a qualified worker.
- g) Ship building, aircraft manufacturing etc.
- h) The written agreement among the partners is called ‘the partnership deed’. It contains the terms and conditions governing the working of partnership.
- i) There are three levels of management in view of authority and responsibility relationship. They are
 1. Top level management.
 2. Middle level management
 3. Lower level management
- j) Amazon.in and flipkart.com

UNIT I

2. a) Significant Events in IE

5M



- Division of labor (Smith, 1776)
- Standardized parts (Whitney, 1800)
- Scientific management (Taylor, 1881)
- Coordinated assembly line (Ford 1913)
- Gantt charts (Gantt, 1916)
- Motion study (the Gilbreths, 1922)
- Quality control (Shewhart, 1924)
- CPM/PERT (Dupont, 1957)
- MRP (Orlicky, 1960)
- CAD
- Flexible manufacturing systems (FMS)
- Computer integrated manufacturing (CIM)

2 b)

5M

- INDUSTRIAL ENGINEERING TECHNIQUES
 - Product Design and Development
 - Value Analysis
 - Specialization and Standardization
 - Production Design and Process Planning
 - Work system Design
 - Materials Management and Inventory Control
 - Production Planning and Control
 - Quality Engineering, Control and Management
 - Total productive maintenance
 - Operations Research
 - Project management

3 a)

5M

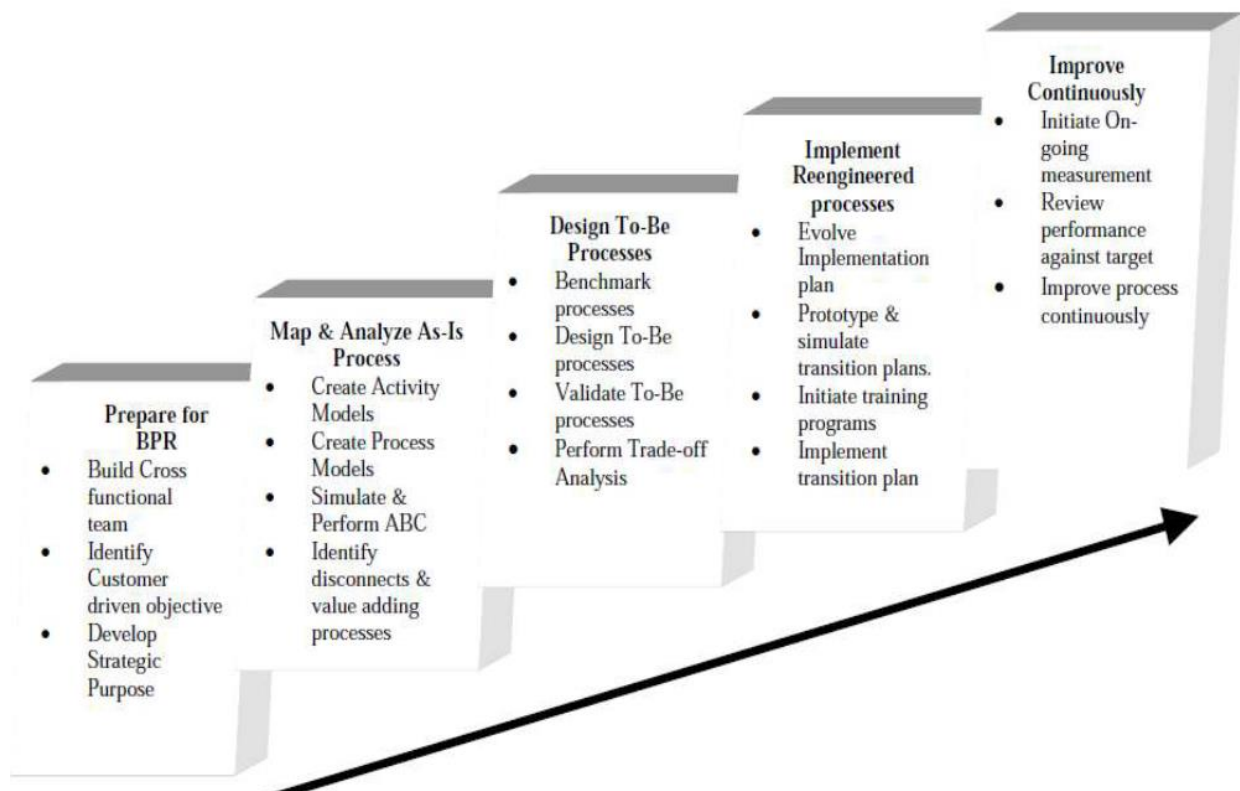
Factors Affecting Productivity:

- Standardization
- Technology
- Use of Internet, fax machines, e-mail, computerized billing, software
- Searching for lost or misplaced items
- Scrap rates
- Labor turnover, layoffs, new workers
- Safety
- Bottlenecks
- Methods
- Design of the workspace
- Incentive plans that reward productivity
- Capacity utilization
- Location

- Layout
- Inventory
- Scheduling
- Shortage of IT workers and other technical workers
- Equipment breakdowns
- Part and material shortages
- Inadequate investment in training & education of the employees

3 b)

Process of BPR



Step 1: Prepare for Reengineering

2M

There must be significant need for the process to be reengineered. Identifying the customer driven objectives, the mission and vision statement is formulated

Step2: Map & Analyze As-Is process

Understand the existing process and its shortfalls and improvement areas of redesign. Activity and process models are documented. Then, the amount and cost of each activity is calculated.

Step3: Design To-Be process

The objective of this phase is to produce one or more alternatives to the current situation that satisfies strategic goals of the enterprise.

Step4: Implement Reengineering Process

Using prototype and simulation method plans are designed and demonstrated. Training programs for the workers are initiated and the plan is executed in full scale

Step5: Improving the reengineering process continuously

The progress of action is measured on change acceptance in broader perspective of the organisation, how well the employee are informed and their commitments. Monitoring the results measures employee attitude, customer perception, supplier responsiveness etc. 3M

UNIT II

4

Multiple activity chart

- Activities of more than one subject each recorded
- Common time scale to show inter-relationship 3M

Uses

- Study idle time
- Determine no. of machines handled by one operator
- Determine no. of operators required 3M

Multiple activity chart for doing three loads of laundry

Time	Operator	Machine 1 Washer	Machine 2 Dryer
# Sec	Load clothes & detergent in machine 1	Being loaded	Idle
	idle	Run	Idle
-	Remove clothes from machine 1	Being unloaded	Idle
-	Load clothes into machine 2	Idle	Being loaded
-	Load clothes & detergent into machine 1	Being loaded	Run
-	Idle	Run	Run
-	Remove clothes from machine 2	Idle	Being unloaded
-	Hang clothes	Idle	Idle

4M

5. THE PRINCIPLES OF MOTION ECONOMY

A. Use of the human body

4M

1. The two hands should begin and complete their movements at the same time

2. Motion of the arms shall be symmetrical and in opposite directions and should be made simultaneously
3. Hands and body motions should be made at the lowest classification at which it is possible to do the work satisfactorily
4. Rhythm is essential to the smooth and automatic performance of a repetitive operation.
5. Work should be arranged so that eye movements are confined to a comfortable area, without the need for frequent changes of focus.

B. Arrangement of the work place

4M

1. Definite and fixed stations should be provided for all tools and materials.
2. Gravity feed, bins and containers should be used to deliver the materials as close to the point of use as possible.
3. Tools, materials and controls should be located within the maximum working area.
4. Materials and tools should be arranged to permit the best sequence of motion.
5. Provision should be made for adequate lighting.
6. The colour of the workplace should contrast with that of the workplace to reduce eye fatigue.

C. Design of tools and equipment

3M

1. The hands should be relieved of all work of 'holding' the workpiece where this can be done by fixture etc.
2. Two or more tools should be combined wherever possible
3. Levers, cross bars and hand-wheels should be so placed that the operative can use them with the least change in body position and the greatest mechanical advantage.

UNIT III

6 a)

5M

Comparison of Rural and Urban sites regarding site selection

<i>Urban</i>	<i>Rural</i>
1. Labour availability-diversified type of labour is available	Difficult to get requisite skilled labour
2. Local demand for the product is fairly high due to large population.	Market place is far away from the enterprise so cost of distribution of finished product is more
3. Good transportation facilities are available	Requisite transportation facilities are not available.
4. In proximity of allied industries.	Away from allied units.
5. Education, recreational health and other social facilities are available.	Absence of educational, recreational social and health facilities.
6. Sufficient land is not available even at higher rates.	Sufficient land is available at cheaper rates.
7. There are many restrictions on factory building construction.	No restrictions on building construction.
8. Certain facilities and public utility services such as water supply drainage and fire fighting etc. are available.	These facilities and public utility services are not available.
9. Prompt postal and communication services are available.	Prompt postal and public telephone services are not available.
10. Tax rates are high.	Taxes are quite low.

BASIS FOR COMPARISON	PRODUCT LAYOUT	PROCESS LAYOUT
Meaning	Product Layout is a type of layout design in which the resources needed to produce the product are arranged in one line, as per the sequence of operations.	Process Layout refers to the type of layout design wherein the resources having homogeneous processes or functions are combined together.
Product	Standardized	Customized
Workflow	Identical flow and sequence of operations for each unit.	Variable flow, relying on the nature of the job.
Inspection	Minimum inspection is there, during the sequence of operations.	Inspection is conducted multiple times during the sequence of operations.
Results in	Transfer lines	Group Technology
Production Time	Less	Comparatively high
Production Cost	High fixed cost and low variable cost.	Comparatively low fixed cost and high variable cost.
Effect of breakdown	Due to the interrelated system, machinery breakdown can seriously affect production.	Machinery breaks down does not have a significant affect on the final output.
Suitable for	Mass production with less job variety.	Moderate production with more job variety.

7 Joint Stock Company

Company Defined

Lord justice Lindley explained the concept of the joint stock company form of organization as ‘an association of many persons who contribute money or money’s worth to a common stock and employ it for a common purpose.’

The persons who conceive the idea of starting a company and who organize the necessary initial resources are called promoters. The vision of the promoters forms the backbone for the company in the future to reckon with.

It is a voluntary association of persons to carry on business.

Members of a joint stock company are known as shareholders and the capital of the company is known as share capital.

Minimum membership of two persons and maximum fifty in case of a Private Limited Company. But in case of a Public Limited Company, the minimum is seven and the maximum membership is unlimited.

The companies are governed by the Indian Companies Act, 1956.

Examples:

Tata Iron & Steel Co. Limited, Hindustan Unilever Limited, Reliance Industries Limited, Steel Authority of India Limited, Ponds India Limited etc.

2M

Features of joint stock company:

3M

The features of the joint stock company are:

1. **Artificial person:** The Company has no form or shape. It is an artificial person created by law. It is intangible, invisible and existing only, in the eyes of law.
2. **Separate legal existence:** It has an independence existence. It is separate from its members. It can acquire the assets. It can borrow for the company. It can sue other if they are in default in payment of dues, breach of contract with it, if any. Similarly, outsiders for any claim can sue it. A shareholder is not liable for the acts of the company. Similarly, the shareholders cannot bind the company by their acts.
3. **Voluntary association of persons:** The Company is an voluntary association of persons who want to carry on business for profit. To carry on business, they need capital. So they invest in the share capital of the company.
4. **Limited Liability:** The shareholders have limited liability i.e., liability limited to the face value of the shares held by him. In other words, the liability of a shareholder is restricted to the extent of his contribution to the share capital of the company. The shareholder need not pay anything, even in times of loss for the company, other than his contribution to the share capital.
5. **Capital is divided into shares:** The total capital is divided into a certain number of units. Each unit is called a share. The price of each share is priced so low that every investor would like to invest in the company. The companies promoted by promoters of good standing (i.e., known for their reputation in terms of reliability character and dynamism) are likely to attract huge resources.
6. **Transferability of shares:** In the company form of organization, the shares can be transferred from one person to the other. A shareholder of a public company can sell his holding of shares at his will.
7. **Common Seal:** As the company is an artificial person created by law has no physical form, it cannot sign its name on a paper; so, it has a common seal on which its name is engraved. The common seal should affix every document or contract; otherwise the company is not bound by such a document or contract.
8. **Perpetual succession:** 'Members may comes and members may go, but the company continues for ever and ever' A. company has uninterrupted existence because of the right given to the shareholders to transfer the shares.

9. **Ownership and Management separated:** The shareholders are spread over the length and breadth of the country, and sometimes, they are from different parts of the world. To facilitate administration, the shareholders elect some among themselves or the promoters of the company as directors to a Board, which looks after the management of the business. The Board recruits the managers and employees at different levels in the management. Thus the management is separated from the owners.
10. **Winding up:** Winding up refers to the putting an end to the company. Because law creates it, only law can put an end to it in special circumstances such as representation from creditors of financial institutions, or shareholders against the company that their interests are not safeguarded. The company is not affected by the death or insolvency of any of its members.
11. **The name of the company ends with 'limited':** It is necessary that the name of the company ends with limited (Ltd.) to give an indication to the outsiders that they are dealing with the company with limited liability and they should be careful about the liability aspect of their transactions with the company.

Advantages of joint stock company:

3M

The following are the advantages of a Public Limited Company

1. **Mobilization of larger resources:** A joint stock company provides opportunity for the investors to invest, even small sums, in the capital of large companies. The facilities rising of larger resources.
2. **Separate legal entity:** The Company has separate legal entity. It is registered under Indian Companies Act, 1956.
3. **Limited liability:** The shareholder has limited liability in respect of the shares held by him. In no case, does his liability exceed more than the face value of the shares allotted to him.
4. **Transferability of shares:** The shares can be transferred to others.
5. **Liquidity of investments:** By providing the transferability of shares, shares can be converted into cash.
6. **Inculcates the habit of savings and investments:** Because the share face value is very low, this promotes the habit of saving among the common man and mobilizes the same towards investments in the company.
7. **Democracy in management:** The shareholders elect the directors in a democratic way in the general body meetings. The shareholders are free to make any proposals, question the practice of the management, suggest the possible remedial measures, as they perceive. The directors respond to the issue raised by the shareholders and have to justify their actions.
8. **Economies of large scale production:** Since the production is in the large scale with large funds at its disposal, the company can enjoy the internal economies of large scale production.
9. **Continued existence:** The Company has perpetual succession. It has no natural end. It continues forever and ever unless law put an end to it.
10. **Institutional confidence:** Financial Institutions prefer to deal with companies in view of their professionalism and financial strengths.
11. **Professional management:** With the larger funds at its disposal, the Board of Directors recruits competent and professional managers to handle the affairs of the company in a professional manner.

12. **Growth and Expansion**: With large resources and professional management, the company can earn good returns on its operations, build good amount of reserves and further consider the proposals for growth and expansion

Disadvantages of joint stock company:

2M

1. **Formation of company is a long drawn procedure**: Promoting a joint stock company involves a long drawn procedure. It is expensive and involves large number of legal formalities.
2. **High degree of government interference**: The government brings out a number of rules and regulations governing the internal conduct of the operations of a company such as meetings, voting, audit and so on, and any violation of these rules results into statutory lapses, punishable under the companies act.
3. **Inordinate delays in decision-making**: As the size of the organization grows, the number of levels in organization also increase in the name of specialization. The more the number of levels, the more is the delay in decision-making. Sometimes, so-called professionals do not respond to the urgencies as required. It promotes delay in administration.
4. **Democratic in theory only**: Dishonest board of directors may exploit the company and whoever has higher number of shares, have more voting power and tries to dominate.
5. **Lack of initiative**: In most of the cases, the employees of the company at different levels show slack in their personal initiative with the result, the opportunities once missed do not recur and the company loses the revenue.
6. **Lack of responsibility and commitment**: In some cases, the managers at different levels are afraid to take risk and more worried about their jobs rather than the huge funds invested in the capital of the company. So the managers may not take up the responsibilities with commitment and may be unable to take business risks.
7. **Conflicting interests**: The company has divergent group of people associated with it. The share holders want maximum dividend. The company wants to maintain good amount of reserves. The board of directors usually justify actions of declaring low or high rate of dividend to reconcile such conflicting interests.
8. **Promotes speculation**: Speculation is the process of expecting a higher price for a particular share and buying it at a lower rate in the stock market. The common investors seldom realize that prices are manipulated.
9. **Lobbying with Government Departments**: The corporate giants because of large base of funds have the capacity to lobby with the Government departments to influence the government policies to suit their business conditions.
10. **Tends to monopoly**: Where the company has grown to larger size, it may fix the price on its own for its products and services as monopolist.
11. **Higher taxes**: The rate of income tax and other taxes is very high when compared to other form of organization.

8 Functions of Management

1. Planning
2. Organizing
3. Staffing
4. Leading/Directing

5. Controlling

2M X 5 = 10 M



PLANNING

It is the ongoing process of developing the business's mission and objectives and determining how they will be accomplished.

Planning includes both the broadcast view of the organization, e.g. its mission, and the narrowest, e.g. a tactic for accomplishing a specific goal.

- *Planning refers to what is to be done, how it is to be done and when it is to be done.*
- *Planning involves choosing tasks that must be performed to attain organizational goals, outlining how the tasks must be performed, and indicating when they should be performed.*

Four steps in Planning are as follows:-

- Objective
- Method
- Timing
- Strategy

Planning is supposed to be done at each and every level of an organization by each and every employee. It is basically forecasting the future course of action. It bridges gap between present and future, planning our vision and mission.

Planning includes:-

- Designing procedures
- Policies
- Rules
- Programmes
- Budgets

Planning can be short run or long run, but it is mostly for both, simultaneously. Short term plans are made to benefit long terms plans.

ORGANIZING

Organizing is an essential function of management.

It is the process of accumulating resources from different sources in order to work according to the plans laid out by the management.

Organizing is accumulating physical, human and monetary resources. This assembling would depend on the objective set by an organization.

Organizing can be thought of as assigning the tasks developed in the planning stages, to various individuals or groups within the organization. Organizing is to create a mechanism to put plans into action.

The function of organizing contains following characteristics:-

- Structuring the functions
- Structuring duties
- Establishing authority - subordinate relationships

Steps of Organization function:-

- Determination of activities of the enterprise in the line of its objectives
- Dividing the activities into appropriate groups
- Assignment of these activities to individuals
- Delegation of authority
- Fixing responsibilities
- Co-ordination of these activities and authority relation

- In short, Organization is all about division of work amongst individuals and co-ordination of their efforts to achieve the objective set by the organization.
- Immediately after planning, the manager needs to organize the team according to plan.
- This involves organizing all of the company's resources to implement a course of action and determining the organizational structure of the group. And in order to do this correctly, management will need to evaluate the different divisions of departments and the staff to figure out the best way to accomplish the tasks needed to reach their goals.

STAFFING

It is function in which qualified people are appointed to different posts relating to their skills and strengths.

The activities included in this function are recruiting, hiring, training, evaluating and compensating.

For achieving an objective, the company needs to appoint individuals for various positions in order to complete that objective.

The purpose of staffing is to control all recruitment and personnel needs of the organization.

After management decides what needs they have, they may decide to hire more employees in a certain department.

It is also responsible for training and development, promotions, transfers, and firing.

A lot of times management and the human resource department will work together because their roles are similar in this case.

LEADING/DIRECTING

Directing is a function that comes after staffing of the organization, it is the function in which the management is supposed to lead, direct to a specific goal and motivate the employees for the achievement of any objective, big or small.

The manager in this function, is supposed to direct or lead appointed individuals and explain them how is their appointed jobs to be done.

Supervision, motivation, leadership, and communication are all involved in the directing function.

Management needs to be able to oversee and influence the behavior of the staff and achieve the company's goals, whether that means assisting or motivating them.

When morale is high within a company, it usually has a significant impact on job performance and efficiency. Incentive programs and rewards are a great way for a business to keep its employees happy and motivated.

CONTROLLING

It is a function in which the performance of the organization is measured and then evaluated after which the standard observed is determined to be either good or bad, which then in turn leads to taking preventive and corrective measures.

In this function the manager is supposed to explain the job essentials to the individuals and guide them in achieving their goals.

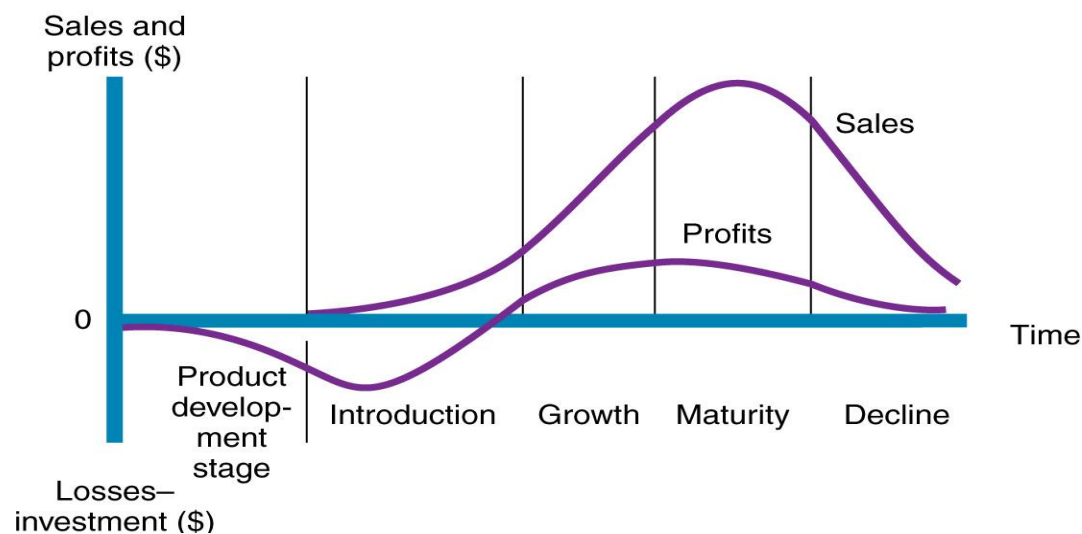
Controlling involves:-

- Measurement of accomplishment against standards
- Analyzing reasons and deviations
- Responsibility Fixation
- Taking corrective measures

Controlling is the following roles played by the manager:-

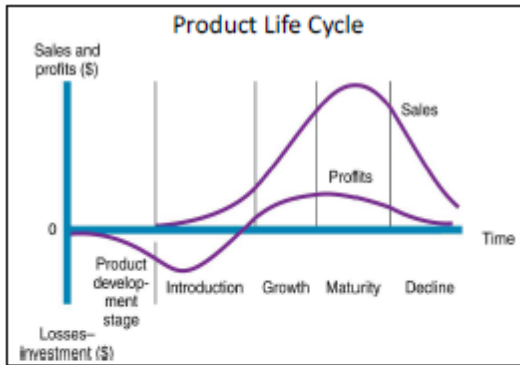
- Gather information that measures performance
- Compare present performance to pre-established performance norms.
- Determine the next action plan and modifications for meeting the desired performance parameters.

9. Product Life Cycle



GRAPH= 2M

2M X 4 STAGES = 8M



Product Life-Cycle Strategies

PLC Stages

- Product development
 - Introduction
 - Growth
 - Maturity
 - Decline

- Begins when the company develops a new-product idea
- Sales are zero
- Investment costs are high
- Profits are negative

Product Life-Cycle Strategies

PLC Stages

- Product development
- Introduction
- Growth
- Maturity
- Decline

- Slow sales growth – cell phones 15 yrs back, Hybrid cars today, Blu-ray technology, HD TV
- Intensive promotions, communications
- Price uncertainty
- Uncertain competition reactions
- Uncertain consumer responses
- Non-existent profits
- Negative cash flow

Product Life-Cycle Strategies

PLC Stages

- Product development
- Introduction
- Growth
- Maturity
- Decline

- Rapid sales growth – cell phones today, Internet, LCD TV
- Market acceptance
- Price stabilization
- Features stabilization
- Profits start coming in
- Brand building starts
- Competition starts building

Product Life-Cycle Strategies

PLC Stages

- Product development
- Introduction
- Growth
- Maturity
- Decline

- Slow sales growth – Land lines, 100cc motorbikes, fountain pens
- Price reductions, promotions
- Features changes / reductions / new
- Profits go down
- Competitors introduce new products
- Brand sustainability is imperative in communication

Product Life-Cycle Strategies

PLC Stages

- Product development
- Introduction
- Growth
- Maturity
- Decline

- Decline in sales – audio & video cassette players, pagers
- New products meet satisfaction
- Profits erode
- Communication expenses are stopped

Introduction Stage of the PLC

Summary of Characteristics, Objectives, & Strategies

Sales	Low
Costs	High cost per customer
Profits	Negative
Marketing Objectives	Create product awareness and trial
Product	Offer a basic product
Price	Use cost-plus formula
Distribution	Build selective distribution
Promotion	Heavy to entice product trial

Growth Stage of the PLC

Summary of Characteristics, Objectives, & Strategies

Sales	Rapidly rising
Costs	Average cost per customer
Profits	Rising
Marketing Objectives	Maximize market share
Product	Offer extension, service, warranty
Price	Penetration strategy
Distribution	Build intensive distribution
Promotion	Reduce to take advantage of demand

Maturity Stage of the PLC	
Summary of Characteristics, Objectives, & Strategies	
Sales	Peak
Costs	Low cost per customer
Profits	High
Marketing Objectives	Maximize profits while defending market share
Product	Diversify brand and models
Price	Match or beat competitors
Distribution	Build more intensive distribution
Promotion	Increase to encourage brand switching

Decline Stage of the PLC	
Summary of Characteristics, Objectives, & Strategies	
Sales	Declining
Costs	Low cost per customer
Profits	Declining
Marketing Objectives	Reduce expenditures and milk the brand
Product	Phase out weak items
Price	Cut price
Distribution	Selective: phase out unprofitable outlets
Promotion	Reduce to minimum level

Marketing Strategies in the PLC				
	Introduction	Growth	Maturity	Decline
Marketing objectives	Create product awareness & trials	Gain market share, create strong positions	Defend market share, create profits	Reduce expenses milk brands
Product strategy	Offer basic Products Eg. Vodafone	Offer product extensions, build service differentiation	Diversify brands, items & models Eg. Blackberry	Phase out weak products
Price	Charge cost Plus	Penetration price promotions, deals Eg Dominos in India	Match pricing to strong competitors	Cut prices
Advertising & Communications	Chosen market segments are addressed	Segment awareness	Advertise differentiation	Reduce levels to retain loyalists
Place	Build Selective Distribution Eg. Hushpuppies	Build intensive distribution	Build more intensive distribution	Go Selective: Phase out unprofitable outlets

****THE END****

Prepared by

Dr. B. Iftekhar Hussain

B.E, M.B.A, PGDIM, PGDMM, M.Tech., Ph.D,
MRPSI, MAMSI, MISTE, MIAENG,

Associate Professor,

Dept. of Mechanical Engg.,Bapatla Engineering College,

Bapatla-522102, Guntur District,

Andhra Pradesh, India.

E mail: iftekharhussain.b@becbapatla.ac.in

Cell: 9966673866