Quantum Series™
ENGINEERING

QUANTUM Series

Semester - 6 Common to all Branches

Industrial Management

Session 2018-19 Even Semester

- Topic-wise coverage of entire syllabus in Question-Answer form.
- Short Questions (2 Marks)

Includes solution of following AKTU Question Papers:

2013-14 • 2014-15 • 2015-16 • 2016-17 • 2017-18

Includes Detailed Analysis of Previous AKTU Question Papers.

CONTENTS

RAS 601 : Industrial Management

Analysis of Previous AKTU Papers

Unit-1 : Introduction							
Part	Topics	2017-18	2016-17	2015-16	2014-15	2013-14	Que. No.
1.	Concept and Scope of Industrial Management	1	1	1	1	1	1.5, 1.6*, 1.7, 1.8
2.	Definition and Measurement of Productivity	0	0	0	2	0	1.9, 1.11
3.	Productivity Index	0	0	0	0	1	1.12
4.	Type of Production System	0	0	1	1	0	1.14, 1.16
5.	Industrial Ownership	2	1	0	2	1	1.22, 1.25, 1.27, 1.28, 1.29, 1.30
	Total Questions	3	2	2	6	3	

* = Asked in different years

Unit-2 : Management Function							
Part	Topics	2017-18	2016-17	2015-16	2014-15	2013-14	Que. No.
1.	Function of Management	0	0	0	0	0	0
2.	Taylor's Scientific Management Theory	1	1	0	0	0	2.3, 2.4
3.	Fayol's Principle of Management	0	0	0	0	1	2.5
4.	Social Responsibilities of Management	0	0	0	0	0	0
5.	Human Resource Management	0	0	0	0	0	0
	Total Questions	1	1	0	0	1	

5. Human Resource Management = New Introduced Topic

Unit-3 : Work Study and Inventory Control							
Part	Topics	2017-18	2016-17	2015-16	2014-15	2013-14	Que. No.
1.	Introduction, Definition, Objectives and Steps in Work Study	0	1	0	1	0	3.3*
2.	Definition, Objectives and Steps of Method Study	0	0	0	0	1	3.5
3.	Purpose, Types of Study, Stop Watch Methods, Steps, Allowance, Standard Time Calculations and Work Sampling	0	0	1	0	1	3.6, 3.7
4.	Production Planning and Control	2	2	2	1	1	3.13*, 3.14, 3.15*
5.	Inventory Cost and Models of Inventory Control	4	3	2	2	3	3.16, 3.18* 3.19*, 3.21, 3.22, 3.23, 3.25, 3.26
	Total Questions	6	6	5	4	6	

* = Asked in different years

Unit-4 : Quality Control							
Part	**Topics**	**2017-18**	**2016-17**	**2015-16**	**2014-15**	**2013-14**	**Que. No.**
1.	**Quality Control**	0	0	1	0	1	4.2, 4.3
2.	**Control Charts**	2	1	1	1	0	4.4*, 4.6, 4.7, 4.8
3.	**Acceptance Sampling**	1	0	0	1	0	4.14*
4.	**Introduction to TQM**	1	0	1	1	2	4.15,* 4.16, 4.17
	Total Questions	**4**	**1**	**3**	**3**	**3**	

*** = Asked in different years**

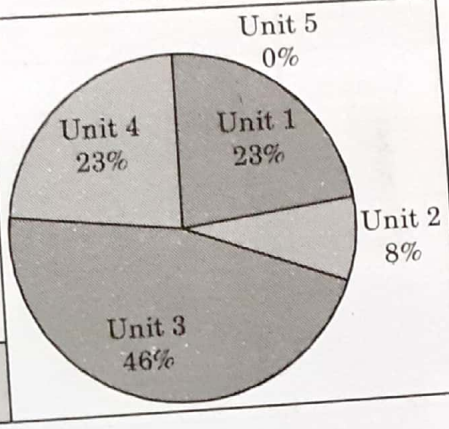
Unit-5 : Project Management							
Part	Topics	2017-18	2016-17	2015-16	2014-15	2013-14	Que. No.
1.	Project Management	0	0	0	0	0	0
2.	Project Network Analysis	0	0	0	0	0	0
3.	CPM, PERT	0	0	0	0	0	0
4.	Project Crashing	0	0	0	0	0	0
5.	Resource Leveling	0	0	0	0	0	0
	Total Questions	0	0	0	0	0	

Project Management = New Introduced Unit

2 Marks Questions						
Units \ Year	2017-18	2016-17	2015-16	2014-15	2013-14	Total Questions
Unit-1	3	3	3	0	0	9
Unit-2	0	0	0	0	0	0
Unit-3	4	2	4	0	0	10
Unit-4	3	2	2	0	0	7
Unit-5	0	0	0	0	0	0

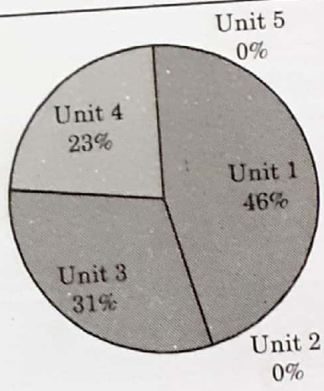
Units	Ques. Asked (2013-14)
Unit-1	3
Unit-2	1
Unit-3	6
Unit-4	3
Unit-5	0

% Weightage of Units (2013-14)



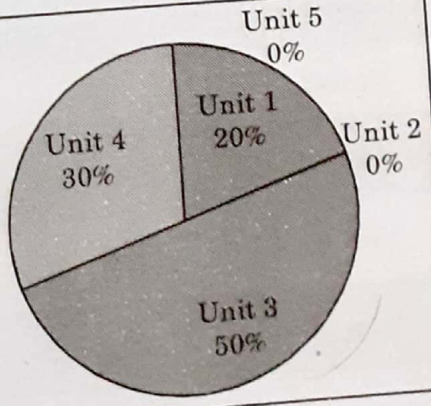
Units	Ques. Asked (2014-15)
Unit-1	6
Unit-2	0
Unit-3	4
Unit-4	3
Unit-5	0

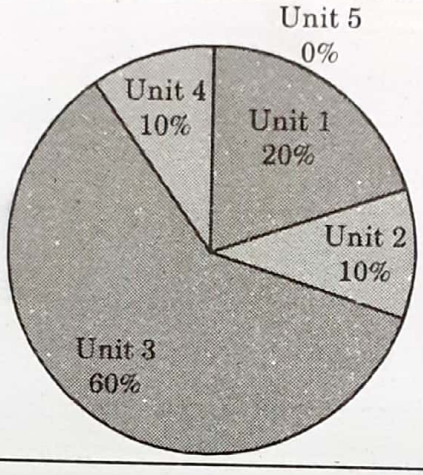
% Weightage of Units (2014-15)

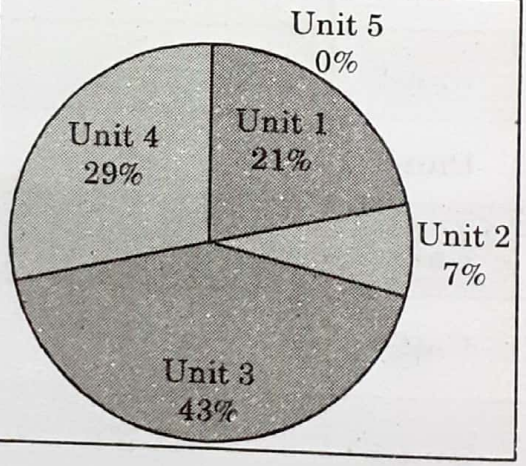


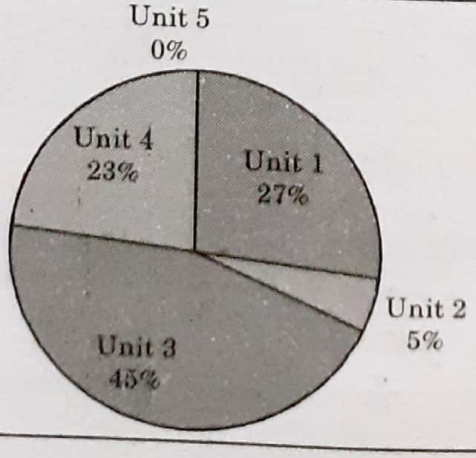
Units	Ques. Asked (2015-16)
Unit-1	2
Unit-2	0
Unit-3	5
Unit-4	3
Unit-5	0

% Weightage of Units (2015-16)



Units	Ques. Asked (2016-17)	% Weightage of Units (2016-17)
Unit-1	2	
Unit-2	1	
Unit-3	6	
Unit-4	1	
Unit-5	0	

Units	Ques. Asked (2017-18)	% Weightage of Units (2017-18)
Unit-1	3	
Unit-2	1	
Unit-3	6	
Unit-4	4	
Unit-5	0	

Units	Total Questions (2013-14 to 2017-18)	% Weightage of Units (2013-14 to 2017-18)
Unit-1	16	
Unit-2	3	
Unit-3	27	
Unit-4	14	
Unit-5	0	

1

UNIT

Introduction

CONTENTS

PART-1

Concept and Scope of Industrial Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 1.1. Define industrial management.

OR

What is industrial management as a branch of engineering ?

Answer

1. The branch of engineering that deals with the creation and management of systems that integrate people and materials and energy in productive ways.
2. The discipline dealing with the art or science of applying scientific knowledge to practical problems and solve problems in a systematic manner in effective and efficient ways.
3. Industrial management is a branch of engineering which deals with the optimization of complex processes or systems.
4. Industrial management work to eliminate waste of time, money, materials, man-hours, machine time, energy and other resources.

Que 1.2. Explain the features and importance of management.

Answer

A. Features of Management :

1. Management is a specialty in dealing with matters of time and human relationships as they arise in organizations.
2. Management is an attempt to create a desirable future, keeping the past and present in mind.
3. Management is practiced in and is a reflection of a particular historical era.
4. Management act in relationship that are two way street; each party is influenced by the other. Also, management juggles multiple simultaneous relationships.

B. Importance of Management :

1. Management is a function beyond planning, so as to ensure how far the plans are performed and whether those needs to be changed depending upon changing environment and conditions.
2. Major tasks of management make it important for an organization. It is important for an enterprise because it performs the following functions :

i. Forecasting
ii. Planning
iii. Organizing
iv. Directing
v. Motivating
vi. Coordination
vii Controlling
viii. Communication
ix. Leadership
x. Decision making

Que 1.3. Describe the scope of industrial management in the field of engineering.

Answer

Industrial management covers following areas in the field of engineering :

i. Expertise Help :

1. Help in all decision making and problem solving.
2. Help in the design of production system.
3. Help in design, selection and implementation of new technology.

ii. Advice and Consultancy :

1. Interpretation of data and information.
2. Review of data and information.
3. Productivity measurement and improvement.

iii. System Analysis :

1. Identification of faults in the production system.
2. Job analysis of the system.

iv. Training and Motivation :

1. Motivation practice of employee.
2. Work and motion study.
3. Training of workers in motion study.
4. Application of new technology.

5. Negotiation.

v. Decision Making :

1. Application of operation research in management.
2. Development and use of decision tools.
3. Use of MIS and Computers.

Que 1.4. What are the applications of industrial management in engineering ?

OR

What are the applications of industrial management ?

Answer

Applications of industrial management are as follows :

1. **Pre-production Planning :** Plant location, capacity planning, selection of machinery and equipments, plant layout, material handling.
2. **Pre-production Planning and Control :** Planning, routing, scheduling, dispatching, controlling.
3. Inventory management and store keeping.
4. Total quality management.
5. **To improve the process and service in :** Finance, Marketing, Human resource.

Que 1.5. What is industrial management ? Describe about the application and scope of industrial management in the field of engineering. **AKTU 2013-14, Marks 10**

Answer

A. **Industrial Management :** Refer Q. 1.1, Page 1–2Y, Unit-1.
B. **Application of Industrial Management :** Refer Q. 1.4, Page 1–4Y, Unit-1.
C. **Scope of Industrial Management :** Refer Q. 1.3, Page 1–3Y, Unit-1.

Que 1.6. Write a detailed note on development of industrial management. **AKTU 2014-15, Marks 05** **AKTU 2016-17, Marks 10**

Answer

The study of development of management can be put under three distinct phases as follows :

A. Classical School of Thought :

F.W. Taylor	Development of scientific management
F.B. Gilberth	Time and motion studies
Henry L. Gantt	The Gantt chart
H. Fayol	General theory of management
Max Weber	Rules

B. Neo-Classical School of Thought :

Mary Parker Follet	Group influences.
Elton Mayo	Effect of human motivation on productivity and output.
Abraham Maslow	Relates human motivation to hierarchy of needs.
Douglas McGregor	Puts emphasis on human characteristics theory *X* and theory *Y* and the corresponding style of leadership.
Chris Argyris	Human & organizational development.

C. Modern Approaches :

Quantitative school of thought	Different branches of quantitative approaches are management science, operation management, MIS.
System theory approach	It considers organization as a whole because of interdependent nature of activities requiring organization to interact with external environment factors.
Contingency theory approach	This approach discards the concept of universality in management principles and determines managerial decisions considering situational factors.

Que 1.7. Write detailed note on development and scope of industrial management. **AKTU 2015-16, Marks 10**

Answer

A. Development of Industrial Management : Refer Q. 1.6, Page 1–4Y, Unit-1.

B. Scope of Industrial Management : Refer Q. 1.3, Page 1–3Y, Unit-1.

Que 1.8. **Give a historical view on industrial management. Also explain the recent developments, taken place in the field of IM.**

AKTU 2017-18, Marks 10

Answer

A. Historical View on Industrial Management : Refer Q. 1.6, Page 1–4Y, Unit-1.

B. Recent Developments taken Place in Field of IM : Several forces are significantly shaping management practices today, including the pace of change, technology, globalization, diversity, and social expectations. To address all this challenges management has responded in two ways :

1. Management has become more specific with the formation of different disciplines. Managers now focus on specific aspects of organizational management : operations management, financial management, marketing management, human resource management, etc. By limiting the number of factors and issues they must deal with, managers can develop practices that address the specific issues they face in their discipline.
2. Management has also become more general. Managers are not provided with an instructional manual that tells them how to manage. Instead, they are given a toolbox of different theories and practices. Effective managers need to know what tool to use and how to use it in different circumstances.

PART-2

Productivity: Definition, Measurement.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 1.9. **Define productivity. State its importance giving suitable examples.**

AKTU 2014-15, Marks 05

Answer

A. Productivity :

1. Productivity is a ratio of actual output (production) to what is required to produce it (inputs).

2. Output means the amount produced or the number of items produced and inputs are the various resources employed, for example, land, building, equipment and machinery, materials, labours, etc.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

B. Importance of Productivity :

1. Productivity is a tool required in evaluating and monitoring the performance of an organization, especially a business organization.
2. Proper use of productivity measures can give the manager an indication of how to improve productivity: either increase the numerator of the measure, decrease the denominator, or both.
3. Productivity measures can be used to compare its performance with similar firms and competitors, compare performance among different departments within the firm.
4. Example : If two firms have the same level of output, but one requires less input leads to a higher level of productivity, that firm will be able to charge a lower price and increase its market share or charge the same price as the competitor and enjoy a larger profit margin.

Que 1.10. What are the basic objectives of productivity measurement ? Explain different kind of productivity measurement.

Answer

A. Objectives of Productivity Measurement :

1. To study performance of a system over time.
2. To have relative comparison of different systems for a given level.
3. To compare the actual productivity of the system with its planned productivity.

B. Kind of Productivity Measurement :

i. **Land Productivity :** The productivity of land and building is said to have increased if the output of goods and services within that area is increased.

ii. **Material Productivity :** Output can be measured in total quantity produced and material can be measured in terms of cost of material required to produce that output.

$$\text{Material productivity} = \frac{\text{Number of units produced}}{\text{Cost of material}}$$

iii. **Labour Productivity :** Output can be measured in total quantity produced and labour can be measured in total man hours required to produce that output.

$$\text{Labour productivity} = \frac{\text{Number of units produced}}{\text{Man hours utilized}}$$

iv. **Machine Productivity :** Output can be measured in total quantity produced and machine can be measured in total machine hours required to produce that output.

$$\text{Machine productivity} = \frac{\text{Actual output}}{\text{Actual machine hours utilized}}$$

v. **Capital Productivity :**

1. Capital productivity may be described as the ratio between the amount produced and the amount of capital used for that production.
2. To measure productivity we have to think in terms of time, since it is the output of goods or services from a machine or from a worker in a given number of machine hours.
3. So, capital productivity is the ratio of turn over to total machine hours required to produce that turn over.

$$\text{Capital productivity} = \frac{\text{Turn over}}{\text{Actual machine hours utilized}}$$

Que 1.11. What are the benefits of increasing productivity to the workers and management ? **AKTU 2014-15, Marks 05**

Answer

Benefits of increasing productivity to the workers and management are as follows :

A. For Management : It helps management :

1. To earn good profit because of reduction in costs.
2. To sell more, to earn profit.
3. To have better utilization of resources.
4. To stand better in the market.
5. Provide overall prosperity and reputation of the company.

B. For Workers :

1. Higher wages.
2. Better working conditions, improved morale.
3. Higher standard of living.
4. Job security and satisfaction.

PART-3

Productivity Index.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 1.12. Write short notes on productivity index.

AKTU 2013-14, Marks 05

Answer

1. Productivity index is used to compare the productivity during the current year with the productivity during the base year.

$$\text{Productivity index} = \frac{\text{Productivity during the current year}}{\text{Productivity during the base year}}$$

2. Base year is any year which the company uses for comparative study.
3. Since productivity is a relative measure, for it to be meaningful or useful it must be compared to something.
4. By tracking productivity indexes over time, managers can evaluate the success, or lack thereof, of projects and decisions.

PART-4

Types of Production System.

Questions-Answers

Long Answer Type and Medium Answer Type Quest

Que 1.13. Explain different types of production systems with appropriate examples.

Answer

Types of production systems are as follows :

A. Intermittent System :

1. In this system, the goods are manufactured specially to fulfill orders made by customers rather than for stock.
2. Intermittent production systems are those where the production facilities are flexible enough to handle a wide variety of products and sizes.

i. Features of an Intermittent System :

1. Demand can be discontinuous.
2. All operational stages may not be balanced.
3. Elaborate sequencing and scheduling is required.
4. Needs high investment.
5. Planning, routing and scheduling changes with fresh orders.
6. Storage is necessary at each stage of production process.
7. Can adjust to new situation and specification.
8. Inspection is not in line with production.

ii. Types of Intermittent System : There are two types of intermittent system :

a. Job Production or Project Type Production : In this system, the goods are produced to definite customer's orders.

Example : Ship building, dam construction, bridge building, book printing, etc.

b. Batch Production : The items are processed in lots or batches unlike job type system where one item is produced during each production run.

Example : Biscuit and confectionery and motor manufacturing, medicines, tinned food and hardware like nuts and bolts etc.

B. Continuous System :

1. In this system, the items are produced for the stocks and not for specific orders.
2. Here the inputs are standardized and a standard set of processes and sequence of processes can be adopted. In continuous manufacturing system each production run manufactures in large lot.

i. Features of Continuous Systems :

1. There must be continuity of demand.
2. The product must be standardized.
3. Material should be as per the specifications and delivered in time.

4. All operational stages in the process must be balanced.
5. Work must conform to quality standards.
6. Appropriate plant and equipment must be provided.
7. Maintenance must be by anticipation and not by default.
8. Inspection must be in line with production.

ii. **Types of Continuous System :** There are two types of continuous system :

a. **Mass Production :** Here items are produced in large quantities and much emphasis is not given to consumers orders. Uniform and uninterrupted flow of material is maintained through predetermined sequence of operations.

Example : Newspapers and magazines etc.

b. **Process Production :** This system is analogous to mass production system with more stress on automation in production process. The volume of production is very high.

Example : Process manufacturing goods include food, beverages, refined oil, petroleum, pharmaceuticals, chemicals and plastics, etc.

Que 1.14. Define productivity. Explain different types of production systems with appropriate examples.

AKTU 2015-16, Marks 10

Answer

A. **Productivity :** Refer Q. 1.9, Page 1–6Y, Unit-1.

B. **Types of Production System with Appropriate Examples :** Refer Q. 1.13, Page 1–9Y, Unit-1.

Que 1.15. Differentiate between intermittent and continuous production process.

Answer

S. No.	Intermittent Production Process	Continuous Production Process
1.	Same product is not produced continuously.	Same product is produced continuously.
2.	Items produced for order.	Items produced for stock.
3.	Production process is flexible.	Process is not flexible.
4.	Equipment used for limited time.	Regular use of equipment.
5.	Wide range of products can be produced.	Only particular type of product is produced.
6.	Smaller scale of production.	Large scale of production.
7.	Planning and control operations are complicated and tedious.	Planning and control operations are simple and easy.
8.	Capital investment may be low.	Capital investment is high.
9.	Change in location is easy.	Change in location is difficult.
10.	Product and process are not standardized.	Product and process are standardized.

Que 1.16. Differentiate between job production, batch production and mass production.

AKTU 2014-15, Marks 05

Answer

S. No.	Mass Production	Batch Production	Job Production
1.	Quantity produced is very large.	A limited batch quantity is produced.	One or few products are produced.
2.	Product is highly standardized.	Product is standardized.	As specified by the customer.
3.	Mostly single purpose machines and special purpose machines are used.	Special purpose machines and general purpose machines are used.	General purpose machines are used.
4.	Production planning is done thoroughly.	Production planning is necessary for each batch.	Production planning is done for each product.
5.	Product layout is used.	Combination of process and product layout is used.	A process layout or layout by fixed position is used.
6.	Scheduling is fixed.	Scheduling is done for each batch.	Scheduling is prepared for each job.
7.	Control function is easy.	Control function is sometimes easy.	Controlling is difficult.
8.	Semi-skilled workers are sufficient.	Semi-skilled workers are sufficient.	Highly skilled workers are needed.
9.	Unit cost is less.	Unit cost is high.	Unit cost is very high.
10.	Supervision is easy.	Supervision is not that easy.	Supervision is difficult.

Que 1.17. Differentiate between production and productivity.

Answer

S.No.	Features	Productivity	Production
1.	**Definition**	It is defined as the rate at which goods are produced.	It is defined as the act of manufacturing goods for their use or sale.
2.	**Use**	It is the utilization of resources to form goods.	It is the actual process of conversion.
3.	**Work Done**	It is the amount of work one gets for a certain spending cost.	It is the amount of work done or manufactured that is the output.
4.	**Measurement**	It is the measure of efficiency.	It is the measure of produced goods.

PART-5

Industrial Ownership.

Questions-Answers

Long Answer Type and Medium Answer Type Quest

Que 1.18. What are the different types of industrial ownership ?

Answer

Following are the different types of industrial ownership :

1. Single ownership (Sole proprietorship).
2. Partnership.
3. Joint Hindu undivided family.
4. Public sector.
5. Cooperative societies.
6. Joint sector.

Que 1.19. Explain sole proprietorship (single owner) in detail.

Answer

A. Sole Proprietorship :

1. Sole proprietorship is a one man business organisation.
2. It is the type of entity that is fully owned and managed by one natural person (not a legal person/entity) known as the sole proprietor.
3. It is the simplest form of business organisation and the ideal choice to run a small or medium scale business.

B. Features of Sole Proprietorship :

i. **Lack of Legal Formalities :** A sole proprietorship does not require incorporation or registration of any kind, only a license is required to carry out the desired business.

ii. **Liability :** Since there is no separation between the owner and the business, the liability of the owner is also unlimited.

iii. **Risk and Profit :** The owner is the only risk bearer in a sole proprietorship. So he must bear the full risk in exchange for enjoying full profits.

iv. **No Separate Identity :** In legal terms, the business and the owner are one and the same.

v. **Continuity :** The death, retirement, bankruptcy, insanity, imprisonment etc will have an effect on the sole proprietorship. In most of such cases, the proprietorship will cease and the business will come to an end.

C. Advantages of Sole Proprietorship :

i. **Easy to Setup :** A sole proprietorship does not require incorporation or registration of any kind, only a license is required to carry out the desired business.

ii. **Complete Control :** A proprietor will have complete control of the entire business.

iii. **Confidentiality :** Law does not require a proprietorship to publish its financial accounts or any other such documents to any members of the public. This allows the business a great deal of confidentiality.

iv. **Maximum Incentive :** The owner derives maximum incentive from the business. He does not have to share any of his profits.

D. Disadvantages of Sole Proprietorship :

i. **Unlimited Liability :** One of the biggest limitations of a sole proprietorship is the unlimited liability of the owner.

ii. **Limited Capital :** Own personal savings and money he can borrow may not be enough to expand the business. Banks and financial institutions are also wary lending to proprietorships

iii. **Life Cycle :** The life cycle of a sole proprietorship is undecided and attached to its owner.

iv. **Limited Managerial ability :** A sole proprietor cannot be an expert in all the fields of the business. This may lead to the business suffering from mismanagement and poor decisions.

Que 1.20. Explain partnership firm in detail.

Answer

A. Partnership :

1. The Indian Partnership Act 1932 defines a partnership as "the relation between two or more persons who have agreed to share the profits from a business carried on by either all of them or any of them on behalf of/acting for all".

2. A partnership must be a result of an agreement between two or more individuals.

3. The agreement must be built to share the profits obtained from the business.
4. The entity is collectively called a "Partnership Firm" and all the individual members are the "Partners".

B. Features of Partnership :

i. **Formation/Contract :** According to the act, a firm must be formed via a legal agreement between all the partners. So, a contract must be entered to form a partnership firm.

ii. **Unlimited Liability :** The partners are all individually and jointly liable for the firm and the payment of all debts. This means that even personal assets of a partner can be liquidated to meet the debts of the firm.

iii. **Continuity :** The death or retirement or bankruptcy or insolvency or insanity of a partner will dissolve the partnership. The remaining partners may continue the partnership if they so choose, but a new contract must be drawn up.

iv. **Number of Members :** As we know that there should be a minimum of two members for a partnership. For a banking business, the number of partners must not exceed ten. For a business of any other nature, the maximum number is twenty.

v. **Principal Agent Relationship :** While dealing with firm's transactions, each partner is entitled to represent the firm and other partners. In this way, a partner is an agent of the firm and of the other partners.

C. Advantages of Partnership :

i. **Easy Formation :** It is relatively easy to form. Legal formalities associated with formation are minimal. Though, the registration of a partnership is desirable, but not obligatory.

ii. **More Capital Available :** Partnership overcomes the problem of funds, because there is more than one person who provide funds to the enterprise. It also increases the borrowing capacity of the firm.

iii. **Combined Talent, Judgment and Skill :** As there is more than one owner in partnership, all the partners are involved in decision making. Usually, partners are pooled from different specialised areas to complement each other.

iv. **Diffusion of Risk :** In partnership, the losses of the firm are shared by all the partners as per their agreed profit sharing ratios.

v. **Flexibility:** The partners can easily appreciate and quickly react to the changing conditions.

D. Disadvantages of Partnership :

i. **Unlimited Liability :** In partnership firm, the liability of partners is unlimited. The partners, personal assets may be at risk if the business cannot pay its debts.

ii. **Divided Authority :** Sometimes disagreements between the partners over enterprise matters have destroyed many a partnership.

iii. **Lack of Continuity :** Death or withdrawal of one partner causes the partnership to come to an end. So, there remains uncertainty in continuity of partnership.

iv. **Risk of Implied Authority :** Risk involved in decisions taken by one partner is to be borne by other partners also.

v. **Lack of a Central Figure :** Leadership can both uplift and derail a firm. Combined ownership takes away the possibility of leadership and lack of leadership leads to directionless operations.

Que 1.21. Explain joint Hindu Undivided Family with its features, advantages and disadvantages.

Answer

A. Joint Hindu Undivided Family :

1. The Joint Hindu Family Business or the Hindu Undivided Family (HUF) is a unique form of business organisation found only in India.
2. It is governed and dictated by the Hindu law.
3. The head of such a joint family business is the eldest member of the family, the "Karta". He is the main person responsible for the business and the finances.
4. Any person born into the family (boy or girl) upto the next coming three generations is a part of the HUF. These members are the co-parceners.

B. Features of a HUF :

i. **Formation :** To begin a Hindu Undivided Family there must be a minimum of two related family members. There must be some assets, business or ancestral property that they have inherited or will eventually inherit. The formation of a HUF does not require any documentation and admission of new members is by birth.

ii. **Liability :** The liability of all the various co-parceners is only upto their share of the property or business. But the Karta being the head of the HUF has unlimited liability.

iii. **Control :** The entire control of the entity lies with the Karta.

iv. **Continuity :** The HUF can be continued perpetually. At the death of the Karta, the next eldest member will become the Karta

v. **Minority :** Even minor members will be a part of the HUF. But they will enjoy only the benefits of the organisation.

C. Advantages of the HUF :

i. **Easy to Start :** It is very easy to start the Joint Hindu Family Business. No legal formalities are required to be faced, such as registration. It requires no agreement.

ii. **Secrecy :** In Joint Hindu Family Business, all the decisions are taken by the 'Karta' himself. He is in a position to keep all the affairs to himself and maintains perfect secrecy in all matters.

iii. **Prompt Decision :** Karta being the sole master, he takes prompt decisions and makes advantage of the opportunity.

iv. **Credit Facilities :** In Joint Hindu Family Business the credit facilities are more. One reason for this is that liability of the 'Karta' is unlimited. Karta is having personal relations with others, which are also helpful in raising credit.

v. **Freedom regarding Selection of Business :** The Karta is at freedom to select any business of his choice. He has not to depend on others.

D. Disadvantages of the HUF :

i. **Limited Membership :** The membership of the business is limited to the members of family only. No outsider can become the member of Joint Hindu Family Business.

ii. **Limited Sources of Capital :** The capital is limited only upto the resources of one family.

iii. **Limited Managerial Skill :** The Karta may not be able to perform all managerial functions because of limitation of time, energy and skills.

iv. **Unlimited Liability :** The liability of the Karta is unlimited. The Karta is not only liable to the extent of his share in the business but his separate property is equally attachable and amount of debt can be recovered from his separate property. This factor puts a ceiling on the growth and expansion of the business.

v. **Misuse of Power :** The management of a Joint Hindu Family Business is centralised in the hands of Karta of the family. No other member can interfere in his management. This may lead to the misuse of power and the Karta may use the power for his personal interest.

Que 1.22. What is public sector organization? What are its aims and objectives ?

AKTU 2014-15, Marks 05

Answer

A. Public Sector Organization :

1. A public sector enterprise is owned and managed by the state.
2. The aim of such enterprises is not to earn profit but to prevent unbalanced growth of industries and ultimately attain self reliance.
3. Such enterprises are accountable for their results to parliament and state legislature.
4. Public enterprises are mostly operated in case of public utility services like water supply, electricity, transportation, etc.

B. Objectives of Public Sector Organization :

1. Equitable distribution of wealth and income by preventing concentration of economic power in few hands.

2. Balanced economic development through dispersal of industrial location.
3. Adequate employment opportunities.
4. Speedy agricultural and industrial development without the growth of monopolies.
5. Self-sufficiency of the nation in modern technology and managerial skills so that in due course, the country need not depend on foreign collaboration in capital technology, skill, etc.
6. To act as role-model for private sector by avoiding exploitation of workers and consumers.

Que 1.23. What are cooperative societies ? Explain them with their advantages and disadvantages.

Answer

A. Cooperative Societies :

1. It is a voluntary association of persons joined together on the basis of equality for fulfillment of their economic and business interests.
2. To protect the interest of weaker sections, the cooperative society is formed.
3. A group of ten persons can form a cooperative society.
4. In India, such societies function under the cooperative societies act, 1912 and other state cooperative societies act.
5. On the basis of objectives, various types of cooperatives are formed. They are consumer cooperatives, producers cooperatives, marketing cooperatives, housing cooperatives and credit cooperatives.

B. Features of Cooperative Societies :

1. As it is a voluntary association, the membership is also voluntary.
2. It is compulsory for the cooperative society to get registration.
3. It does not get affected by the entry or exit of its members.
4. There is a limited liability of the members of cooperative society. Liability is limited to the extent of the amount contributed by members as capital.
5. An elected managing committee has the powers to take decisions.
6. The cooperative society works on the principle of mutual help and welfare.

C. Advantages of Cooperative Societies :

1. It is easy to form a cooperative society.
2. The liability of every member is limited to the extent of capital contributed by him.
3. Any individual can be a member of any cooperative society.

4. Cooperatives get a financial assistance from the state governments and enjoy exemptions and concessions in taxes.
5. The middleman's profit is eliminated as the consumers control their own supplies through cooperative societies.
6. Each member has only one vote. Hence, it is managed in democratic manner.
7. It has got perpetual succession and enjoys legal entity.

D. Disadvantages of Cooperative Societies :

1. Cooperatives do not function efficiently due to lack of managerial abilities.
2. It does not enjoy professionalism as they cannot employ professionals at initial stages due to limited funds.
3. Cooperatives are formed to render service to its members than to earn profit.
4. Among the members, there exists lot of conflicts due to personality differences, ego etc.
5. Secrecy cannot be maintained in cooperative societies.
6. The cooperative societies mostly depend on government for financial assistance.

Que 1.24. Explain the features of Joint Stock Company with its advantages and disadvantages.

Answer

A. Joint Stock Company :

1. A joint stock company is a business organization that is owned jointly by all its shareholders.
2. All the shareholders own a certain amount of stock in the company, which is represented by their shares.
3. When dealing with business on a fairly large scale, a joint stock company is the most suitable form of business organization.

B. Features of a Joint Stock Company :

i. **Artificial Legal Person :** A company is a legal entity like a natural person, it can do certain things, like own property in its name, enter into a contract, borrow and lend money, sue or be sued etc.

ii. **Separate Legal Entity :** A member of the company is not liable for the company and similarly, the company will not depend on any of its members for any business activities.

iii. **Incorporation :** Without incorporation, a company simply does not exist.

iv. **Perpetual Succession :** Members or shareholders of a company keep changing, but this does not affect the company's life.

v. **Limited Liability :** Only the company's assets can be sold off to repay its own debt. The members cannot be made to pay up.

vi. **Common Seal :** A common seal is engraved seal with the company's name on it. No document is legally binding on the company until and unless it has a common seal along with the signatures of the directors.

vii. **Transferability of Shares :** In a joint stock company, the ownership is divided into transferable units known as shares.

C. **Advantages of a Joint Stock Company :**

i. **Limited Liability :** The liability of the member is only limited up to the unpaid amount on their shares. Since their personal wealth is safe, they are encouraged to invest in joint stock companies.

ii. **Transferability :** The shares of a company are transferable.

iii. **Perpetual Succession :** The death/retirement/insanity/etc does affect the life of a company. Only liquidation under the companies act will shut down a company.

iv. **Efficient Management :** Very proficient, talented people are elected to the board and this result in effective and efficient management. Also, a company usually has large resources and this allows them to hire the best talent and professionals.

D. **Disadvantages of a Joint Stock Company :**

i. **Complex and Lengthy Procedure :** One disadvantage of a joint stock company is the complex and lengthy procedure for its formation. This can take up to several weeks and is a costly affair as well.

ii. **Lack of Secrecy and Freedom :** According to the Companies Act, 2013 all public companies have to provide their financial records and other related documents to the registrar. These documents are then public documents, which any member of the public can access. A company has to follow a numerous number of laws, regulations, notifications etc. It not only takes up time but also reduces the freedom of a company.

iii. **Conflict of Interest :** A company has many stakeholders, all these stakeholders look out for their benefit and it often leads to a conflict of interest.

Que 1.25. Compare Joint Stock Company with partnership organization.

OR

What is meant by Joint Stock Company ? Compare it with partnership organization. **AKTU 2014-15, Marks 05**

Answer

A. **Joint Stock Company :** Refer Q. 1.24, Page 1–20Y, Unit-1.

B. Comparison between Joint Stock Company and Partnership Organization :

S. No.	Features	Partnership	Joint Stock Companies
1.	**Minimum Number of Members**	Minimum number of members is two.	Minimum number is two in a private company and seven in a public company.
2.	**Maximum Number of Members**	Maximum number of members is 20 in general business and 10 in banking firms.	Maximum number of members is 50 in a private company and there is no maximum limit in public company.
3.	**Separate Legal Existence**	No separate legal existence.	Separate legal existence.
4.	**Legislation**	Regulated under the Partnership Act, 1932.	Regulated under the Companies Act, 1956.
5.	**Capital**	Huge capital cannot be secured.	Possibility of securing huge capital.
6.	**Liability**	Liability of each partner is unlimited.	Liability of each shareholder is limited.
7.	**Management**	Managed by the partners themselves.	Management will be in the hands of elected directors.
8.	**Perpetual succession**	No continuous existence.	Continuous existence.

Que 1.26. Distinguish between limited and unlimited liability.

Answer

S. No.	Limited Liability	Unlimited Liability
1.	In this, liability of the investors or owner of a company is limited to the amount of money they have contributed.	In this, the liabilities of the owners or investors are not limited to the amount that they have contributed.
2.	The owners of the business are responsible for the debt equal to the value of his shares.	The owners of the business are responsible for any debt.
3.	Exists in partnership firm.	Exists in proprietorship.

Que 1.27. **What are the different patterns of industrial ownership ? Detail any one.** **AKTU 2013-14, Marks 10**

Answer

A. Different Patterns of Industrial Ownership : Refer Q. 1.18, Page 1–14Y, Unit-1.

B. Sole Proprietorship : Refer Q. 1.19, Page 1–14Y, Unit-1.

Que 1.28. **What are the different patterns of industrial ownership ? Explain them with their advantages and disadvantages.** **AKTU 2016-17, Marks 10**

Answer

A. Different Patterns of Industrial Ownership : Refer Q. 1.18, Page 1–14Y, Unit-1.

B. Advantages and Disadvantages :

i. Single Ownership : Refer 1.19, Page 1–14Y, Unit-1.

ii. Partnership : Refer 1.20, Page 1–15Y, Unit-1.

iii. Joint Hindu Undivided Family : Refer 1.21, Page 1–17Y, Unit-1.

iv. Public Sector : Refer 1.22, Page 1–18Y, Unit-1.

v. Cooperative Societies : Refer 1.23, Page 1–19Y, Unit-1.

vi. Joint Sector : Refer 1.24, Page 1–20Y, Unit-1.

Que 1.29. **Joint Stock Company does not suffer from limitations of capital and management. Justify.** **AKTU 2017-18, Marks 10**

Answer

1. A joint stock company sells the shares, debentures, and bonds on large scale. So, a joint stock company can collect a large amount of capital.
2. As the number of members is not restricted, it is easy to raise huge amount of capital for a joint stock company.
3. A company has better chances of obtaining finance and credit facility as it enjoys better public confidence and reputation in the market.
4. Since the directors of companies are elected by the shareholders, they will elect efficient people who will manage the business affairs in an efficient manner.
5. These directors are generally experienced and qualified in business field. This increases the efficiency of the company.

Que 1.30. **Discuss the different types of ownership. Distinguish between limited and unlimited liability.** **AKTU 2017-18, Marks 10**

Answer

A. **Different Types of Ownership :** Refer Q. 1.18, Page 1–14Y, Unit-1.

B. **Difference between Limited and Unlimited Liability :** Refer Q. 1.26, Page 1–22Y, Unit-1.

2 UNIT

Management Function

CONTENTS

PART-1

Functions of Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 2.1. Define management and discuss its essential characteristics.

OR

What do you mean by management ?

Answer

A. Management : It is the process of planning, organizing, leading and controlling the efforts of organization members and of using all other organization resources to achieve stated organizational goal.

B. Characteristics of Management :

a. Management as an Activity :

1. The management uses systematically human and material resources.
2. It receives and gives information to their subordinates as well as supervisors.
3. The manager should solve their social and psychological problems. They should provide them opportunities for growth and advancement so that they may realise that they are also contributing towards organizational objectives.

b. Management as a Process :

1. A series of action is called process which is utilized in the function of management. Thus management process moves towards an objective for an enterprise to get it achieved by taking several steps.
2. These steps are planning, organizing, staffing, directing and controlling and are used to reach to organization goals. Thus, the process has the following two aspects :

i. Management is an inter-related process.

ii. Management is a continuous process.

c. Management as a Group :

1. The top management of the concern determines the goal by strategic planning, making appropriate policy and finally controlling the overall activities of the organization.

2. It includes all the managers and executives together with the board of directors and chairman of the board.

Que 2.2. What are the functions of management ?

OR

Describe the functions of management.

Answer

The essential functions/elements/components of management are as follows :

a. Planning :

1. Planning is the primary function of management.
2. It involves determination of a course of action to achieve desired results/ objectives.
3. It is the starting point of management process and all other functions of management are related to and dependent on planning function.
4. It is the key to success, stability and prosperity in business.

b. Organizing :

1. It means to bring the resources (men, materials, machines, etc.) together and use them properly for achieving the objectives.
2. Organizing means arranging ways and means for the execution of a business plan.

c. Staffing :

1. Staffing refers to manpower required for the execution of a business plan.
2. Every business unit needs efficient, stable and cooperative staff for the management of business activities.
3. Manpower is the most important asset of a business unit. 'Right man for the right job' is the basic principle in staffing.

d. Directing (Leading) :

1. It deals with guiding and instructing people to do the work in the right manner.
2. Directing/leading is the responsibility of managers at all levels. They have to work as leaders of their subordinates.
3. Clear plans and sound organization set the stage but it requires a manager to direct and lead his men for achieving the objectives.

e. Coordinating :

1. Effective coordination and also integration of activities of different departments are essential for orderly working of an Organization.
2. A manager must coordinate the work for which he is accountable.

f. Controlling :

1. Controlling is necessary in the case of individuals and departments so as to avoid wrong actions and activities.
2. Controlling involves three broad aspects :

i. Establishing standards of performance,

ii. Measuring work in progress and interpreting results achieved, and

iii. Taking corrective actions, if required.

3. Business plans do not give positive results automatically. Managers have to exercise effective control in order to bring success to a business plan.

g. Motivating :

1. It is a managerial function in which a manager motivates his men to give their best to the organization.
2. Motivation is actually inspiring and encouraging people to work more and contribute more to achieve organizational objectives.
3. It is a psychological process of great significance.

h. Communicating :

1. Communication (written or oral) is necessary for the exchange of facts, opinions, ideas and information between individual's and departments.
2. In an organization, communication is useful for giving information, guidance and instructions.
3. Managers should be good communicators.
4. They have to use major portion of their time on communication in order to direct, motivate and co-ordinate activities of their subordinates.

PART-2

Taylor's Scientific Management Theory.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 2.3. Explain in detail the "Scientific approach" to management and how it is helpful for organization ?

AKTU 2017-18, Marks 10

Answer

1. Scientific management is a theory of management that analyzes and synthesizes workflows.F.W Taylor is referred as the father of scientific management.
2. Its main objective is improving economic efficiency, especially labour productivity.
3. It was one of the earliest attempts to apply science to the engineering of processes and to management.

A. **Four Principles of Scientific Management :**

i. Replace working by "rule of thumb," or simple habit and common sense, and instead use the scientific method to study work and determine the most efficient way to perform specific tasks.

ii. Rather than simply assign workers to just any job, match workers to their jobs based on capability and motivation, and train them to work at maximum efficiency.

iii. Monitor worker performance, and provide instructions and supervision to ensure that they are using the most efficient ways of working.

iv. There must be equal division of work between the managers and the workers. Allocate the work between managers and workers so that the managers spend their time planning and training, allowing the workers to perform their tasks efficiently.

B. Scientific approach to management or scientific management is helpful for organization in following ways :

1. **Reduction in the Cost of Production :** It increases production with the help of mechanization and latest technology used in producing the goods. On account of large scale production, per unit.cost of production is considerably reduced.
2. **Better Quality Products :** By resorting to the measures of standardization and effective supervision, better quality products are ensured.
3. **Benefits of Division of Labour :** The principle of specialization adopted under scientific management ensures the benefits derived from the division of labour. The work is simplified and is carried out in most economical and efficient manner.
4. **Avoidance of Disputes between Labour and Management :** Scientific management is instrumental in developing healthy cooperation between the management and the labour thereby encouraging cordial and harmonious relations between the two. This leads to reduction in industrial disputes and provides of industrial peace.
5. **Increased Wages :** Scientific management aims at higher productivity and the workers get increased wages. Relating wage payments to the efficiency of the workers, *i.e.*, giving wages at the higher rates to the efficient workers.

6. **Gains to Owners/Investors :** Increased productivity and large scale production leads to more turnovers and enhanced profits for the investor.
7. **Proper Methods of Selection and Training of Workers :** One of the main principles of scientific management is that it undertakes scientific selection, placement and training of industrial workers. In this manner, right type of man is selected for the right type of job.
8. **Provision of Better Working Conditions :** Scientific management provides a proper working hours followed by rest pauses, adequate lighting, ventilation, ensuring proper safety, provision of many other amenities etc., are ensured to workers.
9. **Instructions to Workers :** Under scientific management detailed instructions and guidance is provided to workers in order to carry out the work in accordance with the plans prepared in advance.
10. **Lesser Production Time :** Scientific management leads to the accomplishment of the work in lesser time. Production operations are pre-established and this results in lesser production delays.
11. **Better Utilization of Resources :** Scientific management techniques ensure optimum utilization of available resources viz., materials, machines, equipment, money and workers etc. It removes the wastage and inefficiency of every kind.
12. **Gains to Consumers :** Consumers get better quality products, paying lesser prices and attaining higher living standards.
13. **Beneficial to the Nation :** Scientific management provides many advantages to a nation in the form industrial peace and harmony, increased production and lesser cost of production, higher standard of living for every section of society, higher national income, rapid industrial development etc.

Que 2.4. **Who is referred as the father of scientific management ? What are the principles and goal of scientific management ?**

AKTU 2016-17, Marks 15

Answer

F.W. Taylor is referred as the father of scientific management.

A. **Four Principles of Scientific Management :** Refer Q. 2.3, Page 2–4Y, Unit-2.

B. **Goal of Scientific Management :**

a. **Increased Production :** Increase in the rate of production by use of standardized tools, equipment and methods.

b. **Quality Control :** Improvement in the quality of the output by research and quality control inspection devices.

c. **Cost Reduction :** Reduction in the cost of production by rational planning and regulation, and cost control techniques.

d. **Elimination of Wastes** and methods of producti

e. **Right Men for Right** jobs through scientific s

f. **Incentive Wages :** Pay efficiency.

Fayol's P

Q

Long Answer Type a

Que 2.5. **What do you fourteen 'principles of ma**

Describe the principles o

Answer

A. **Management :** Refer Q

B. A principle is a basic sta to thinking and action management. They are

1. **Division of Work :** Div a particular work is ass leads to satisfaction. The the quality of the work.
2. **Authority and Respo** area, he can perform in n
3. **Discipline :** Discipline departments.
4. **Unity of command :** instructions from only o
5. **Unity of Direction :** Th head for each group of a
6. **Unbiasing Among Em** should not be permitted enterprise.

d. **Elimination of Wastes :** Elimination of wastes in the use of resources and methods of production.

e. **Right Men for Right Work :** Placement of right persons on the right jobs through scientific selection and training.

f. **Incentive Wages :** Payment of wages to workers according to their efficiency.

PART-3

Fayol's Principles of Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 2.5. What do you think about management ? Elaborate fourteen 'principles of management' by Sir Henry Fayol.

AKTU 2013-14, Marks 10

OR

Describe the principles of management.

Answer

A. **Management :** Refer Q. 2.1, Page 2–2Y, Unit-2.

B. A principle is a basic statement that provides understanding and guide to thinking and action. Henry Fayol listed fourteen principles of management. They are :

1. **Division of Work :** Dividing the work among different workers so that a particular work is assigned to the perfect worker. Division of work leads to satisfaction. The main advantage of this principle is to improve the quality of the work.
2. **Authority and Responsibility :** If a person has full authority in his area, he can perform in much better way and complete his responsibility.
3. **Discipline :** Discipline is necessary for proper functioning of all the departments.
4. **Unity of command :** The employees should receive orders and instructions from only one direction (boss).
5. **Unity of Direction :** This implies that there should be one plan and one head for each group of activities having the same object.
6. **Unbiasing Among Employees :** The interests of an individual person should not be permitted to superseded upon the general interests of the enterprise.

7. **Remuneration :** Remuneration should be given to the employees to bring maximum satisfaction. It can be fair wages or other monetary benefits.
8. **Authority Centralization :** The top management or authority should be centralized for the best overall performance of the organization.
9. **Smooth Leveling of Management :** There should be an unbroken line of authority and command through all levels from top level managers to lowest ranked employee (clerk).
10. **Order :** Everything in an enterprise should be in proper order. That may be materials or man. Everyone should has own specific place in the organization.
11. **Equity of Treatment :** The manager of the organization should deal with the subordinates with equality and respect.
12. **Stability :** An employee is able to deliver better when he is secure in his job. It is the duty of the management to offer job security to their employee along with a promise of growth.
13. **Initiative :** Initiative is one of the keenest satisfactions for an intelligent employee.
14. **Team Spirit :** There should be team work among employees for the overall growth of enterprise and the employees.

PART-4

Social Responsibilities of Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 2.6. Define social responsibility. What are the different kinds of social responsibilities of business enterprises ?

Answer

1. Social responsibility denotes differentiating right from wrong and doing the right thing.
2. Social responsibility is management's obligation to make choices and take actions that contributes to the well-being and interests of society as well as the organization.
3. The obligation that every management is subjected to can be divided into four responsibilities :

i. **Economic Responsibility :** In an economic responsibility, business is expected to produce goods and services that are beneficial for society and society which wants and sell them at a profit.

ii. **Legal Responsibility :** Every business enterprise is expected to operate within the legal frame work of our society. A law abiding enterprise gets no interference of government and is considered as a socially responsible enterprise.

iii. **Ethical Responsibility :** Ethics is much more than law, while behaving ethically businessmen should not be involved in adulteration, black marketing, etc.

iv. **Discretionary Responsibility :** This responsibility is purely voluntary. This includes contribution in charity. Participation in social service projects, setting up educational and training institutions etc., helping people affected by flood, earthquake etc.

Que 2.7. **What are the social responsibilities of an enterprise towards different section / group in the society ?**

Answer

The social responsibilities of an enterprise for different section/ group of the society can be classified as :

i. **Responsibilities Towards Consumers :**

a. Production of safe items by maintaining quality standards.

b. Being truthful in advertising.

c. To follow fair trade practices.

ii. **Responsibilities Towards Employee :**

a. Providing fair compensation and benefits.

b. Providing good and safe working conditions.

c. To give them opportunities to participate in decision making.

iii. **Responsibilities Towards the Owners / Shareholders / Investors :**

a. To ensure safety of investment.

b. To ensure fair and regular return on investment.

c. To ensure appreciation of investment by proper utilization of resources.

iv. **Responsibilities Towards the Government :**

a. To abide by rules, regulations and laws.

b. To pay taxes and duties on time.

c. To help in solving social problem.

v. **Responsibilities Towards the Community :**

a. To protect the environment from all types of pollution.

b. To provide more employment opportunities.

c. To help the weaker section of the society.

vi. Responsibilities Towards Suppliers :

a. To ensure regular payment to the supplier.

b. To adopt fair dealing with the suppliers.

c. To protect and assist small scale suppliers by placing order with them.

vii. Responsibilities Towards Competitors :

a. To have a healthy competitive spirit.

b. To not use unfair means to succeed in business.

c. To not harm or defame the competitors.

d. To not copy competitors strategy.

Que 2.8. What is the role of business in protecting the environment ?

Answer

It is the social responsibility of every business to take steps not only to check all sorts of pollution but also to protect environmental resources.

i. A definite commitment by top management of the enterprise to create, maintain and develop work culture for environmental protection and pollution prevention.

ii. Ensuring that commitment to environmental protection is shared throughout the enterprise by all divisions and employees.

iii. Developing clear-cut policies and programmes for purchasing good quality raw materials, employing superior technology, using scientific techniques of disposal and treatment of wastes and developing employee skills for the purpose of pollution control.

iv. Complying with the laws and regulations enacted by the government for prevention of pollution.

v. Participation in government programmes relating to management of hazardous substances, clearing up of polluted rivers, plantation of trees, and checking deforestation.

vi. Periodical assessment of pollution control programmes in terms of costs and benefits so as to increase the progress with respect to environmental protection.

vii. Arranging educational workshops and training materials to share technical information and experience with suppliers, dealers and customers to get them actively involved in pollution control programmes.

PART-5

Human Resource Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 2.9. What is human resource ? What is human resource management and what are its objectives ?

Answer

Human resources are the people who work for an organization in jobs that produce the products or services of the business or organization.

1. Human resource management is a process, which consists of four main activities namely, acquisition, development, motivation, as well as maintenance of human resources.
2. HRM focuses on the function of people within the business, ensuring best work practices are in place at all times.
3. **Objectives :** The specific objectives of human resource management are as follows :

i. To ensure effective utilization of human resources, all other organizational resources will be efficiently utilized by the human resources.

ii. To establish and maintain an adequate organizational structure of relationship among all the members of an organization by dividing of organization tasks into functions, positions and jobs, and by defining clearly the responsibility, accountability, authority for each job and its relation with other jobs in the organization.

iii. To generate maximum development of human resources within the organization by offering opportunities for advancement to employees through training and education.

iv. To ensure respect for human beings by providing various services and welfare facilities to the personnel.

v. To ensure reconciliation of individual/group goals with those of the organization in such a manner that the personnel feel a sense of commitment and loyalty towards it.

vi. To identify and satisfy the needs of individuals by offering various monetary and non-monetary rewards.

Que 2.10. Explain the nature of human resource management.

Answer

Human Resource Management is a process of bringing people and organizations together so that the goals of each are met. The various features or nature of HRM include :

1. It is pervasive in nature as it is present in all enterprises.

2. Its focus is on results rather than on rules.
3. It tries to help employees develop their potential fully.
4. It encourages employees to give their best to the organization.
5. It is all about people at work, both as individuals and groups.
6. It tries to put people on assigned jobs in order to produce good results.
7. It helps an organization meet its goals in the future by providing for competent and well-motivated employees.
8. It tries to build and maintain cordial relations between people working at various levels in the organization.
9. It is a multi-disciplinary activity, utilizing knowledge and inputs drawn from psychology, economics, etc.

Que 2.11. Discuss the functions of human resource management.

Answer

The main functions of human resource management are classified into two categories :

a. **Managerial Functions :** Following are the managerial functions of human resources management :

1. **Planning :** The planning function of human resource department pertains to the steps taken in determining in advance personnel requirements, personnel programmes, policies etc. After determining how many and what type of people are required, a personnel manager has to devise ways and means to motivate them.
2. **Organization :** Under organization, the human resource manager has to organise the operative functions by designing structure of relationship among jobs, personnel and physical factors in such a way so as to have maximum contribution towards organizational objectives. In this way a personnel manager performs following functions :

a. preparation of task force;
b. allocation of work to individuals;
c. integration of the efforts of the task force;
d. coordination of work of individual with that of the department.

3. **Directing :** Directing is concerned with initiation of organized action and stimulating the people to work. A personnel manager guides and ,motivates the staff of the organization to follow the path laid down in advance.
4. **Controlling :** It provides basic data for establishing standards, makes job analysis and performance appraisal, etc. All these techniques assist in effective control of the qualities, time and efforts of workers.

b. **Operative Functions :** The following are the operative functions of human resource management :

1. **Procurement of Personnel :** It is concerned with the obtaining of the proper kind and number of personnel necessary to accomplish organization goals. It deals specifically with manpower requirements, their recruitment, selecting, placement and orientation, etc.

2. **Development of Personnel :** Development has to do with the increase through training, skill that is necessary for proper job performance. In this process various techniques of training are used to develop the employees.
3. **Compensation to Personnel :** Compensation means determination of adequate and equitable remuneration of personnel for their contribution to organization objectives. It also assists the organization for adopting the suitable wages and salaries, policy and payment of wages and salaries in right time.
4. **Maintaining Good Industrial Relation :** Human Resource Management covers a wide field. It is intended to reduce strife's, promote industrial peace, provide fair deal to workers and establish industrial democracy.
5. **Record Keeping :** In record keeping the personnel manager collects and maintains information concerned with the staff of the organization. It is essential for every organization because it assists the management in decision making such as in promotions.
6. **Personnel Planning and Evaluation :** Under this system different type of activities are evaluated such as evaluation of performance, personnel policy of an organization and its practices, personnel audit, morale, survey and performance appraisal, etc.

Que 2.12. Describe the importance of HRM.

Answer

The role of human resource management is very important in an organization and it should not be undermined especially in large scale enterprises. Because of the following reasons human resource management holds a place of importance :

1. It helps management in the preparation adoption and continuing evolution of personnel programmes and policies.
2. It supplies skilled workers through scientific selection process.
3. It ensures maximum benefit out of the expenditure on training and development and appreciates the human assets.
4. It prepares workers according to the changing needs of industry and environment.
5. It motivates workers and upgrades them so as to enable them to accomplish the organization goals.
6. Through innovation and experimentation in the fields of personnel, it helps in reducing casts and helps in increasing productivity.
7. It contributes a lot in restoring the industrial harmony and healthy employer-employee relations.
8. It establishes mechanism for the administration of personnel services that are delegated to the personnel department.

☺☺☺

3

UNIT

Work Study and Inventory Control

CONTENTS

PART-1

Work Study : Introduction, Definition, Objectives, Steps in Work Study.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 3.1. Define Work Study. State its objectives and advantages.

Answer

A. Work Study : It is a technique used to examine the activities done by human being and investigate those factors that affect the accuracy and efficiency of the workers. Work study helps to complete a particular work or job in the best possible way.

B. Objectives of Work Study : The following are the objectives of work study :

1. Increased efficiency.
2. Better product quality.
3. To choose the fastest method to do a job.
4. To improve the working process.
5. Less fatigue to operators and workers.
6. Effective labour control.
7. Effective utilization of resources.
8. To decide equipment requirements.
9. To pay fair wages.
10. To aid in calculating exact delivery.
11. To formulate realistic labour budgeting.
12. To decide the required manpower to do a job.

C. Advantages of Work Study: The advantages of work study are as follows :

1. Work study ensures higher productivity.
2. Better working conditions with less fatigue.
3. Higher wages to workers.
4. Uniform production flow.
5. Job satisfaction and job security to workers.

6. Reduction in unit cost of production.
7. Quality products to consumers.
8. Fast delivery schedule.
9. Harmonious employer-employee relation.
10. Better service to customers.

Que 3.2. What are the steps in work study ?

Answer

The steps of work study are as follows :

1. It selects the jobs which are to be studied.
2. It examines critically the recorded facts which are already done.
3. It records from direct observations all the matters which are happened.
4. It defines new method.
5. It also installs the new method.
6. It also maintains the new standard.
7. It develops most economic and appropriate methods.
8. It measures the work content in the method that is selected and compute a standard time.

Que 3.3. Define 'work study' and state its objectives. Differentiate between 'method study' and 'work measurement'.

AKTU 2014-15, 2016-17; Marks 10

Answer

A. Work Study and Its Objectives : Refer Q. 3.1, Page 3–2Y, Unit-3.

B. Difference Between Method Study and Work Measurement :

S. No.	Method Study	Work Measurement
1.	Examine the facts.	Analyze the facts.
2.	Install the new method.	Compile the standard time.
3.	Improve factory, office and workplace layout.	Improve method of doing work.
4.	Also known as work simplification.	Also known as time study.
5.	It ensures safety in all activities.	It ensures correct loading of labour and machinery.

PART-2

Method Study : Definition, Objectives, Steps of Method Study.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 3.4. Define method study. What are its objective and steps ?

Answer

A. **Method Study :** Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing costs. It is a systematic procedure to analyze the work to eliminate unnecessary operations.

B. **Objective of Method Study :** The following are the objectives of method study :

1. It improves the proper utilization of manpower, machine and materials.
2. It also improves the factory layout, work place, etc.
3. It also improves the process and procedure.
4. It develops better physical working environment.
5. It reduces undesirable fatigue.

C. **Steps of Method Study :** The steps of method study are :

1. At first select the proper work which is to be studied.
2. Record all the facts of existing method.
3. Examine the facts very critically.
4. Develop the most practical, economic, and effective method.
5. Install the method and the same should be maintained.

Que 3.5. Write short note on Motion Study.

AKTU 2013-14, Marks 05

Answer

A. Motion Study :

1. The movement of a worker is very important for manufacturing of the products.
2. Motion study is the science of eliminating unused or waste material from useful material.
3. It is a systematic and scientific method of the motions of unnecessary waste and undesired motions.

B. Steps of Motion Study : The steps of motion study are :

1. Select the job.
2. Collect the data or facts related to the work.
3. Examine the facts collected.
4. Develop the latest and improved method.
5. Install the new method.

C. Objectives of Motion Study : The following are the objectives of motion study :

1. Removal of unwanted motions.
2. Increase the efficiency of all activities.
3. Improve the proper motion of activities.
4. Enhancing the material handling process.
5. Ensure the smooth and safe running of the activities.

PART-3

Work Measurement : Purpose, Types of Study, Stop Watch Methods, Steps Allowances, Standard Time Calculations, Work Sampling.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 3.6. **What is the role of 'Time Study' in production ?**

AKTU 2013-14, Marks 10

Answer

1. When a customer wants to purchase some products, then he usually compares the prices with those of similar products, which are being manufactured by other producers.
2. Therefore, to give competitive quotations, estimation of accurate labour cost is very essential as it has got large effect on the price.
3. Secondly, whenever a customer contracts for the purchase of certain products then he desires that the products should reach to him at a promised date which is only possible when manufacturer is aware of the time to be taken by the product during manufacture.
4. Therefore, to find the correct manufacturing time for product, time study is performed.
5. Time study also helps in analysis of work and standardization of methods.

Que 3.7. Explain the steps required in making time study ?

AKTU 2015-16, Marks 10

Answer

Following are the steps required in making time study :

Step I : Define objective of the study. This involves statement of the use of the result, the precision desired, and the required level of confidence in the estimated time standards.

Step II : Verify that the standard method and conditions exist for the operation and the operator is properly trained.

Step III : Select operator to be studied if there are more than one operator doing the same task.

Step IV : Record information about the standard method, operation, operator, product, equipment, and conditions on the time study observation sheet.

Step V : Divide the operation into reasonably small elements, and record them on the time study observation sheet.

Step VI : Time the operator for each of the elements. Record the data for a few numbers of cycles on the time study observation sheet. Use the data to estimate the total number of observations to be taken.

Step VII : Collect and record the data of required number of cycles by timing and rating the operator.

Step VIII : Calculate the representative watch time for each element of operation. Multiply it by the rating factor to get normal time.

Normal time = Observed time × Rating factor

Calculate the normal time for the whole operation by adding the normal time of its various elements.

Step IX : Determine allowances for fatigue and various delays.

Step X : Determine standard time of operation.

Standard time = Normal time + Allowances

Que 3.8. Define stopwatch methods of work measurement ? Explain its importance.

Answer

A. Stopwatch Method of Work Measurement :

i. Definition : Stopwatch time study measures how long it takes an average worker to complete a task at a normal pace.

ii. Methods of timing using Stopwatch : There are two methods of timing using a stop watch. They are :

a. Fly Back Method :

1. Here the stopwatch is started at the beginning of the first element. At the end of the element the reading is noted in the study sheet.
2. At the same time, the stopwatch hand is snapped back to zero. This is done by pressing down the knob, immediately the knob is released.
3. The hand starts moving from zero for timing the next element. Thus the timing for each element found is called observed time.

b. Continuous Method :

1. Here the stopwatch is started at the beginning of the first element. The watch runs continuously throughout the study.
2. At the end of each element the watch readings are recorded on the study sheet. The time for each element is calculated by successive subtraction.
3. The final reading of the stopwatch gives the total time known as observed time.

B. Importance : The importance and uses of stopwatch time study can be stated as under:

1. Determining schedules and planning work.
2. Determining standard costs and as an aid in preparing budgets.
3. Estimating the costs of a product before manufacturing it. Such information is of value in preparing bids and determining selling price.
4. Determining machine effectiveness, the number of machines which one person can operate, and as an aid in balancing assembly lines and work done on a conveyor.
5. Determining time standards to be used as a basis for labour cost control.
6. Helps to know the labour productivity, labour efficiency, labour performance and overall time required to perform the task.
7. Helps to improve the process of operation.

Que 3.9. Explain standard tir

Answer

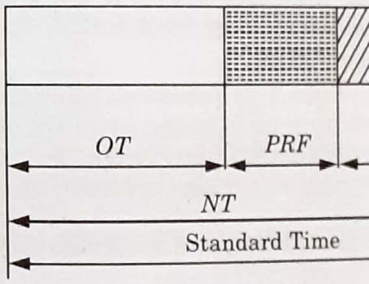
i. Definition :

1. Standard time is the time allowe task under specified conditions
2. The various allowances are adde the standard time "Component Standard time = Normal time +

ii. Standard Time Calculation are :

1. Elemental (observed time).
2. Performance rating to compen
3. Relaxation allowance.
4. Interference and contingency a
5. Policy allowance.

iii. Components Standard Tim



OT - Observed Time
PRF - Performance Ratin
NT - Normal Time
PA - Process Allowance
RPA - Rest and Personal
SA - Special Allowances
PoA - Policy Allowances

Que 3.10. What are allowanc calculating standard time ?

Answer

A. Allowances :

1. It is impossible to work thro practicable, effective method

Que 3.9. Explain standard time calculation.

Answer

i. Definition :

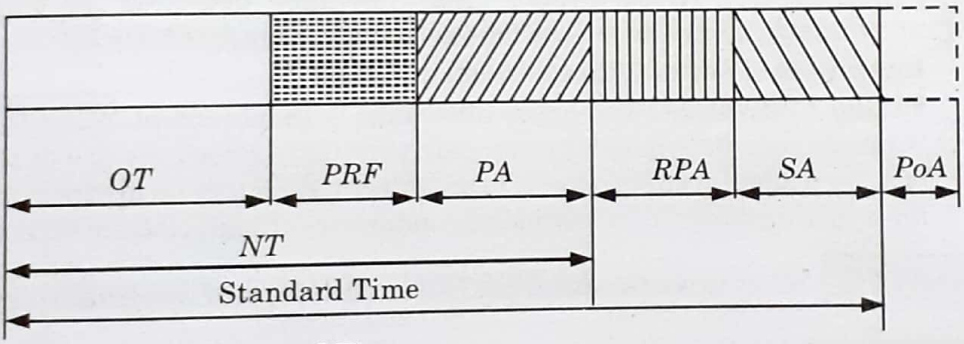
1. Standard time is the time allowed to an operator to carry out the specified task under specified conditions and defined level of performance.
2. The various allowances are added to the normal time as applicable to get the standard time "Components standard time".

   Standard time = Normal time + Allowances

ii. Standard Time Calculation : The basic constituents of standard time are :

1. Elemental (observed time).
2. Performance rating to compensate for difference in pace of working.
3. Relaxation allowance.
4. Interference and contingency allowance.
5. Policy allowance.

iii. Components Standard Time :



OT - Observed Time
PRF - Performance Rating Factor
NT - Normal Time
PA - Process Allowances
RPA - Rest and Personal Allowances
SA - Special Allowances
PoA - Policy Allowances

Que 3.10. What are allowances ? Explain various allowances in calculating standard time ?

Answer

A. Allowances :

1. It is impossible to work throughout the day even though the most practicable, effective method has been developed.

2. Allowances must be made to enable the worker to attend to his personal needs.

B. Various Allowances in Calculating Standard Time are :

1. **Relaxation allowance :** Relaxation allowances are calculated so as to allow the worker to recover from fatigue.

a. **Fixed Allowances :**

i. **Personal Needs Allowance :** It is intended to compensate the operator for the time necessary to attend to personal needs like drinking water, smoking, washing hands.

ii. **Allowances For Basic Fatigue :** This allowance is given to compensate for energy expended during working.

b. **Variable Allowances :** The variable fatigue allowance is added to the fixed allowance to an operator who is engaged on medium and heavy work and working under abnormal conditions that cannot be improved.

2. **Interference Allowance :** This allowance is applicable for machine or process controlled jobs to compensate the operator for the unavoidable loss of production due to simultaneous stoppage of two or more machines being operated by him.

3. **Contingency Allowance :** This allowance provides for small unavoidable delays as well as for occasional minor extra work.
Examples : Power failures of small duration.

4. **Policy Allowance :** The policy allowance is an increment, other than bonus increment, applied to a standard time (or to some constituent part of it, for example, work content) to provide a satisfactory level of earnings for a specified level of performance under exceptional circumstances.

Que 3.11. What is work sampling ? Give the steps of work sampling.

Answer

A. Work Sampling :

i. Definition :

1. Work sampling (also sometimes called ratio delay study) is a technique of getting facts about utilization of machines or human beings through a large number of instantaneous observations taken at random time intervals.

2. The ratio of observations of a given activity to the total observations approximates the percentage of time that the process is in that state of activity.

ii. Use of Work Sampling for Standard Time Determination : Work sampling can be very useful for establishing time standards on both direct and indirect labour jobs.

B. Steps of Work Sampling :

Step 1 : Define the problem.

1. Describe the job for which the
2. Unambiguously state what a
him to be in 'working' state
entitle him to be in "not worki

Step 2 : Design the sampling

1. Estimate satisfactory numbe
2. Decide on the period of study
3. Prepare detailed plan for taki

Step 3 : Contact the persons
regarding conduct of the stud

Step 4 : Make the observatio
the working / not working st
working state, determine his
observation sheet.

Step 5 : Obtain and record ot
starting time and quitting tim
acceptable quality produced d

Step 6 : Calculate the standar

Que 3.12. Differentiate betw

Answer

S. No.	Basis of Comparison	Motion
1.	Meaning	It relates recording movemen workers.
2.	Nature	Motion concerne minimiza movemen
3.	Purpose	The purp study is to best way
4.	Technique	Motion conducte moving ca

1. Describe the job for which the standard time is to be determined.
2. Unambiguously state what are the activities of job that would entitle him to be in 'working' state and any activity other than those would entitle him to be in "not working" state.

Step 2 : Design the sampling plan :

1. Estimate satisfactory number of observations to be made.
2. Decide on the period of study, for example, two days, one week, etc.
3. Prepare detailed plan for taking the observations.

Step 3 : Contact the persons concerned and take them in confidence regarding conduct of the study.

Step 4 : Make the observations at the pre-decided random times about the working / not working state of the operator. When operator is in working state, determine his performance rating. Record both on the observation sheet.

Step 5 : Obtain and record other information. This includes operator's starting time and quitting time of the day and total number of parts of acceptable quality produced during the day.

Step 6 : Calculate the standard time per piece.

Que 3.12. Differentiate between motion and time study.

Answer

S. No.	Basis of Comparison	Motion Study	Time Study
1.	Meaning	It relates to watching and recording the movements of workers.	It involves careful measurement of time required to do the different parts of a job.
2.	Nature	Motion study is concerned with minimization of movement of operators.	Time study is concerned with increasing the productivity to labour.
3.	Purpose	The purpose of motion study is to determine the best way of doing a job.	The purpose of time study is to determine fair day's work.
4.	Technique	Motion study is conducted with a moving camera.	Time study is conducted with a stopwatch.

husband Khader Kukadi, an
engineer working in Dubai,
were on holiday in Colombo.
Mr. Kukadi had checked
out of the hotel earlier on
Sunday and left for Dubai
while Ms. Raseena was to
leave the hotel and visit her

PART-4

Production Planning and Control.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 3.13. **What is production planning ?**

AKTU 2013-14, Marks 10

OR

Define production planning and state its objectives. What are the various steps in production planning ? **AKTU 2015-16, Marks 10**

OR

Define the term production planning. State its objectives. What are the various steps involved in production planning and control ?

AKTU 2016-17, 2017-18; Marks 10

OR

Define the term production planning. State its objectives. What are the various steps in production planning ?

AKTU 2014-15, Marks 10

Answer

A. Production Planning :

1. Production Planning is concerned with the determination, acquisition and arrangement of all facilities necessary for future operations.
2. Production planning means to fix the production goals and to estimate the resources which are required to achieve these goals.
3. It prepares a detailed plan for achieving the production goals economically, efficiently and in time.

B. Objectives of Production Planning :

1. Effective utilization of resources.
2. Steady flow of production.
3. Estimate the resources.
4. Ensures optimum inventory.

5. Coordinates activities
6. Minimize wastage of ra
7. Improves the labour pr
8. Reduces the productio

6.	Inspecti
5.	Follow-
4.	Dispatch
3.	Schedul
2.	Routin
1.	Planni

C. Steps in production

i. Planning :

1. For planning of product will receive full informa produced and the dates
2. The planning departm drawing specifications

ii. Routing :

1. The objective of routing of operations.
2. While preparing the rou the plant are operated facilities are best utilize

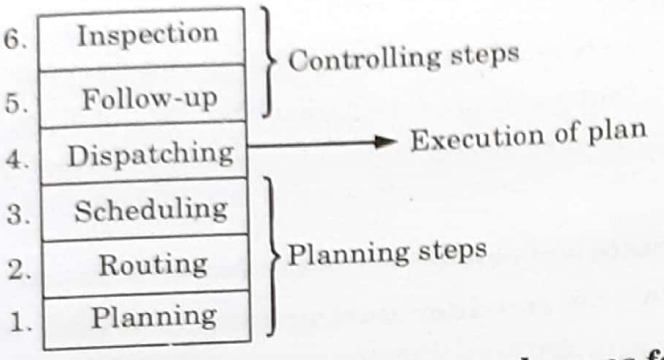
iii. Scheduling :

1. Scheduling involves the time needed for the ma to be spent at each mac
2. In preparing schedules consideration the vario which their completion

iv. Dispatching :

1. Procurement of necessa actually required by the
2. Giving workers the nece for initiating the work.

5. Coordinates activities of departments.
6. Minimize wastage of raw materials.
7. Improves the labour productivity.
8. Reduces the production costs.



C. Steps in production planning and control are as follows :

i. Planning :

1. For planning of productive operations in detail, the planning department will receive full information from management about the quantity to be produced and the dates when delivery has been promised to customers.
2. The planning department will also get the necessary engineering and drawing specifications from the engineering department.

ii. Routing :

1. The objective of routing is to find out the best and the cheapest sequence of operations.
2. While preparing the route card, it must be kept in mind that machines in the plant are operated at their full capacity; and manpower and other facilities are best utilized.

iii. Scheduling :

1. Scheduling involves the preparation of a time-table, indicating the total time needed for the manufacture of a product as also the time expected to be spent at each machine and process.
2. In preparing schedules, the persons concerned will have to take into consideration the various types of orders on hand and the dates by which their completion has been promised.

iv. Dispatching :

1. Procurement of necessary tools, jigs and fixtures etc., before they are actually required by the workmen.
2. Giving workers the necessary work orders, instructions, drawings etc., for initiating the work.

v. Follow-Up (or Checking the Progress) :

1. Follow-up is the control aspect of production planning and control.
2. It involves taking steps to check up whether work proceeds according to plans and how far there are variances from standards; and also taking necessary corrective steps to set things in order.

vi. Inspection :

1. Inspection is the quality control aspect of production planning and control.
2. It ensures that goods produced are of the right quality.
3. The inspectors may inspect materials, semi-finished and finished products either at the work bench or in special laboratories or testing rooms.

Que 3.14. State and explain the objective, importance of production planning. Do you consider outsourcing is a part of production planning ? Explain. **AKTU 2015-16, Marks 10**

Answer

A. Objectives of Production Planning :

1. **Effective Utilization of Resources :** Production planning results in effective utilization of resources, plant capacity and equipment. This results in low-cost and high returns for the organization.
2. **Steady Flow of Production :** Production planning ensures a regular and steady flow of production. Here, all the machines are put to maximum use. This results in a regular production, which helps to give a routine supply to customers.
3. **Estimate the Resources :** Production planning helps to estimate the resources like men, materials, etc. The estimate is made based on sales forecast.
4. **Ensures Optimum Inventory :** Production planning ensures optimum inventory. Stock of raw material is maintained at a proper level in order to meet the production demands. Stock of finished goods is also maintained to meet regular demands from customers.
5. **Coordinates Activities of Departments :** Production planning helps to coordinate the activities of different departments.
6. **Minimize Wastage of Raw Materials :** Production planning ensures proper inventory of raw materials and materials handling. This helps to minimize wastage of raw material.
7. **Improves the Labour Productivity :** There is maximum utilization of manpower. Training is provided to the workers. The profits are shared with the workers in form of increased wages and other incentives. Workers are motivated to perform their best. This results in improved labour efficiency.

8. **Reduces the Product** utilization of resources optimum size of invent

B. Importance / Advan

1. Continuous production
2. Cost-control and profit
3. Customer satisfaction
4. Planning of resource r
5. Minimum material han
6. Economy in production
7. Equipment utilization

C. Outsourcing as Part

1. Instead of employing e at all times it could be as and when needed.
2. Outsourcing firms may of scale, as they may pr businesses.
3. By removing departme when needed, fixed cos
4. Additional capacity can and contracts can be ca closing down whole fac

Que 3.15. Is productio management ? Describe t system.

Answer

1. The primary objective effectively manage and essential for the produc
2. Production managemen to the production of goo
3. Operations managemen by the managers of the
4. Production and operatio it is quite difficult to diff
5. Production management are involved in the proc
6. On the other hand, ope involved in the product

8. **Reduces the Production Costs :** Production planning makes optimum utilization of resources, and it minimizes wastage. It also maintains optimum size of inventories. All this reduces the production costs.

B. Importance / Advantage of Production Planning :

1. Continuous production
2. Cost-control and profit-maximization
3. Customer satisfaction
4. Planning of resource requirements and inventory control
5. Minimum material handling and storage costs
6. Economy in production time
7. Equipment utilization

C. Outsourcing as Part of Production Planning :

1. Instead of employing expensive specialists that might not be kept busy at all times it could be cheaper to 'buy in' specialist services or products as and when needed.
2. Outsourcing firms may be cheaper because they benefit from economies of scale, as they may provide similar services to a large number of other businesses.
3. By removing departments from the staff payroll and buying in services when needed, fixed costs are converted into variable costs.
4. Additional capacity can be obtained from outsourcing only when needed and contracts can be cancelled if demand falls much more quickly than closing down whole factories owned by the business.

Que 3.15. Is production management different from operation management ? Describe the intermittent and continuous production system. **AKTU 2016-17, 2017-18; Marks 05**

Answer

1. The primary objective of production and operations management is to effectively manage and utilize those resources of the firm that are essential for the production of goods and services.
2. Production management refers to the management of activities related to the production of goods.
3. Operations management is the administration of business operations by the managers of the organization.
4. Production and operations management are so closely intertwined, that it is quite difficult to differentiate the two.
5. Production management covers and administers all the activities which are involved in the process of production.
6. On the other hand, operations management entails all the activities involved in the production of goods and delivery of services such as

material management, quality management, maintenance management, process management, process design, product design and so on.

Intermittent and Continuous Production System : Refer Q. 1.13, Page 1–9Y, Unit-1.

PART-5

Inventory Control : Inventory, Cost, Models of Inventory Control : EOQ, ABC, VED.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 3.16. Define inventory. What is direct and indirect inventory ? What are the different costs associated with inventory ?

AKTU 2014-15, Marks 10

Answer

A. Inventory : Inventory is an accounting term that refers to goods that are in various stages of being made ready for sale, including :

Finished goods (that are available to be sold)

Work-in-progress (meaning in the process of being made)

Raw materials (to be used to produce more finished goods)

B. Types of Inventory :

1. Raw material inventory
2. Work in progress (WIP)/Semi-finished inventory
3. Finished goods inventory

C. Classification of Inventory : Inventory can be broadly divided into two main categories :

i. Direct Inventories : These are the inventories that are an integral part of the finished product. Important feature of direct inventories is that you can assign the stock to specific physical units. The different types of direct inventories are :

a. Raw Materials : These are goods which are to be used in the manufacturing process to produce final goods. They are the goods in their raw or natural form. For example, sugarcane is the raw material in a sugar factory.

b. Semi-Finished G
Some further wo
example in a toy
painted will be se

c. Finished Goods
but not yet sold.

ii. Indirect Inventorie
that are necessary fo
component of such go

Example : Petrol or lu
And office supplies us
indirect inventories.

D. Costs Associated w
associated with inven

i. Holding/Carrying C
insurance, taxes, obs
the goods.

ii. Ordering Cost : Orc
an order, including
department, commu

iii. Stock-out Cost : Th
term, when a desire
back ordering the m
production line beca

Que 3.17. Define in
importance.

Answer

A. Inventory Control
inventory at some
interests of an organ
much of various iter

B. Objectives of Inve

1. To maintain the ove
operating requireme
2. To supply the produc
etc. to its users as pe
3. To keep inactive, was
level.

b. **Semi-Finished Goods :** These are also known as work-in-progress. Some further work has to be done before they can be sold. For example in a toy factory, toys that are molded but still have to be painted will be semi-finished goods.

c. **Finished Goods :** These are fully completed goods ready for sale, but not yet sold.

ii. **Indirect Inventories :** Indirect inventories comprise of stock items that are necessary for the manufacturing of goods but are not a direct component of such goods.

Example : Petrol or lubricants used in production are indirect inventories. And office supplies used in administration also fall under the category of indirect inventories.

D. **Costs Associated with Inventories :** There are three types of costs associated with inventory :

i. **Holding/Carrying Cost :** They are expenses such as storage, handling, insurance, taxes, obsolescence, theft, and interest on funds financing the goods.

ii. **Ordering Cost :** Ordering costs are those fees associated with placing an order, including expenses related to personnel in purchasing department, communications, and the handling of related paper work.

iii. **Stock-out Cost :** They include sales that are lost, both short and long term, when a desired item is not available; the costs associated with back ordering the missing item; or expenses related to stopping the production line because a component part has not arrived.

Que 3.17. Define inventory control with its objectives and importance.

Answer

A. **Inventory Control :** It is the technique of maintaining the size of the inventory at some desired level keeping in view the best economic interests of an organization. It is the process of deciding what and how much of various items are to be kept in stock.

B. **Objectives of Inventory Control :**

1. To maintain the overall investment at the lowest level, consistent with operating requirements.
2. To supply the product, raw material, sub-assemblies, semi-finished goods etc. to its users as per their requirements at right time and at right price.
3. To keep inactive, waste, surplus, scrap and obsolete items at the minimum level.

4. To minimize holding, replacement and shortage costs of inventories and maximize the efficiency in production and distribution.
5. To treat inventory as investment which is risky.
6. To protect against inflation since the prices of materials are constantly increasing.
7. To avail quantity discounts on bulk purchases.

C. Importance of Inventory Control :

1. It improves the liquidity position of the firm by reducing unnecessary tying up of capital in excess inventories.
2. It ensures smooth production operations by maintaining reasonable stocks of materials.
3. It facilitates regular and timely supply to customers through adequate stocks of finished products.
4. It protects the firm against variations in raw materials delivery time.
5. It facilitates production scheduling, avoids shortage of materials and duplicate ordering.
6. It helps to minimise loss by obsolescence, deterioration, damage, etc.
7. It enables the firms to take advantage of price fluctuations through economic lot buying when prices are low.

Que 3.18. What are the different costs associated with inventories ?

AKTU 2013-14, Marks 10

OR

Explain classification, need and various costs involved with inventory.

AKTU 2015-16, Marks 7.5

OR

Explain the different costs involved in inventory models ?

AKTU 2017-18, Marks 10

OR

Write short note on inventory costs. **AKTU 2013-14, Marks 05**

Answer

Different Costs Involved in Inventory Models are :

i. **Holding/Carrying Cost :** Inventory storage and maintenance involves various types of costs namely :

a. Inventory Storage Cost :

1. Inventory storage costs typically in facility maintenance and related c equipments, IT hardware and a purchase, depreciation or rental o
2. Further costs include opera communication costs and utilitie resources employed in operations

b. Cost of Capital :

1. Includes the costs of investments, i on inventory paid, insurance costs legal liabilities.
2. The inventory storage costs as we upon and varies with the decision inventory in house or through outs service providers.

ii. **Ordering Costs :**

1. Cost of procurement and inbound logis cost.
2. Ordering cost is dependant and varies b ordering excess and (b) the cost of orde move in opposite directions to each othe
3. Ordering excess quantity will result whereas ordering less will result in inc ordering costs.
4. The functional analysis and cost in determining the inventory procuremer basic fundamental questions - How Mu How much to order is determined by Quantity (EOQ).

iii. **Stock-out Costs :** They include sales t term, when a desired item is not avai back ordering the missing item; or ex production line because a component understand these expenses can lead n inventory levels than customer requir

Que 3.19. What do you understand b

How do you calculate EOQ ? Explain.

OR

Define inventory control with its object quantitative technique with EOQ m

quantity (EOQ) is derived ?

a. Inventory Storage Cost :

1. Inventory storage costs typically include cost of building rental and facility maintenance and related costs. Cost of material handling equipments, IT hardware and applications, including cost of purchase, depreciation or rental or lease as the case may be.
2. Further costs include operational costs, consumables, communication costs and utilities, besides the cost of human resources employed in operations as well as management.

b. Cost of Capital :

1. Includes the costs of investments, interest on working capital, taxes on inventory paid, insurance costs and other costs associate with legal liabilities.
2. The inventory storage costs as well as cost of capital is dependent upon and varies with the decision of the management to manage inventory in house or through outsourced vendors and third party service providers.

ii. Ordering Costs :

1. Cost of procurement and inbound logistics costs form a part of ordering cost.
2. Ordering cost is dependant and varies based on two factors: (a) the cost of ordering excess and (b) the cost of ordering too less. Both these factors move in opposite directions to each other.
3. Ordering excess quantity will result in carrying cost of inventory, whereas ordering less will result in increase of replenishment cost and ordering costs.
4. The functional analysis and cost implications form the basis of determining the inventory procurement decision by answering the two basic fundamental questions - How Much to Order and When to Order. How much to order is determined by arriving at the Economic Order Quantity (EOQ).

iii. Stock-out Costs : They include sales that are lost, both short and long term, when a desired item is not available; the costs associated with back ordering the missing item; or expenses related to stopping the production line because a component part has not arrived. Failing to understand these expenses can lead management to maintain higher inventory levels than customer requirements may justify.

Que 3.19. What do you understand by Economic Order Quantity ? How do you calculate EOQ ? Explain. **AKTU 2014-15, Marks 10**

OR

Define inventory control with its objectives and importance. Explain quantitative technique with EOQ model. How economic order quantity (EOQ) is derived ? **AKTU 2015-16, Marks 10**

OR

Explain the different costs involved in inventory models ? Derive the expression for economic order quantity, when the demand of items is uniform model, the production rate is infinite and no stock-outs are allowed. **AKTU 2017-18, Marks 10**

Answer

A. Inventory Control with Its Objectives and Importance : Refer Q. 3.17, Page 3–16Y, Unit-3.

B. Costs : Refer Q. 3.18, Page 3–17Y, Unit-3.

C. EOQ :

1. By the 'order quantity' we mean the quantity produced or procured during one production cycle.
2. When the size of order increases, the ordering costs (cost of purchasing, inspection etc.) will decrease whereas the inventory carrying costs (cost of storage, insurance, etc.) will increase.
3. Thus in the production process there are two opposite costs, one encourages the increase in the order size and the other discourages.
4. Economic Order Quantity (*EOQ*) is that size of order which minimizes total annual costs of carrying inventory and cost of ordering.
5. The two opposite costs can be shown graphically by plotting them against the order size.
6. It is evident from Fig. 3.19.1 that the minimum total cost occurs at the point where the ordering costs and inventory carrying costs are equal.

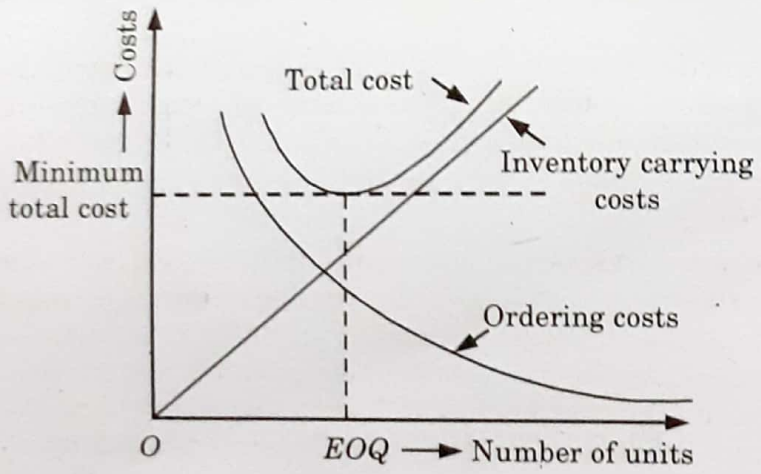


Fig. 3.19.1.

C. Formula for EOQ :

Inventory costs are :

a. $$\text{Ordering cost} = \frac{\text{Total annual demand}}{\text{Quantity order each time}} \times \text{Ordering cost per order}$$

$$= \frac{D}{Q} \times S$$

b. Carrying cost = Average units in inventory × Carrying cost per unit

$$= \frac{Q}{2} \times H$$

The total cost is minimum at a point where ordering cost equals carrying cost

$$\frac{D}{Q} \times S = \frac{Q}{2} \times H$$

Therefore, Economic order quantity *EOQ* is

$$EOQ = \sqrt{\frac{2DS}{H}}$$

EOQ is the economic order quantity (units).

D is demand per year,

S cost per order, and

H cost of holding per unit of inventory.

Que 3.20. The material DX is used uniformly throughout the year. The data about annual requirement, ordering cost and holding cost of this material is given below :
Annual requirement : 2,400 units
Ordering cost : Rs 100 per order
Holding cost : Rs 3 per unit
Determine the Economic Order Quantity (EOQ), of material *DX* number of orders per year, ordering cost, holding cost and combine cost using above data.

Answer

Given : $D = 2400$ units, $S = 100$/order, $H = 3$/unit.
To Find : i. EOQ of material. ii. Number of orders per year. iii. Ordering cost. iv. Holding cost and v. Combine cost.

1. We know that,

$$EOQ = \sqrt{\frac{2DS}{H}}$$

$$EOQ = \sqrt{\frac{2 \times 2400 \times 100}{3}}$$

$$EOQ = \sqrt{\frac{480000}{3}}$$

$$EOQ = \sqrt{160000}$$

$$EOQ = 400$$

The economic order quantity for material *DX* is 400 units.

3. Number of orders per year
   = Annual demand/EOQ
   = 2,400 units/400 units = 6 orders per year
4. Ordering cost
   = Number of orders per year × Cost per order
   = 6 orders × Rs.100 = Rs.600
5. Holding cost
   = Average units × Holding cost per unit
   = (400/2) × 3 = Rs.600
6. Combined ordering and holding cost at Economic Order Quantity (EOQ) :
   = Ordering cost + Holding cost
   = Rs.600 + Rs.600 = Rs.1200

Que 3.21. **The annual demand for an item is 3200 parts. The unit cost is Rs.6 and the inventory carrying charges are estimated as 25 % per annum. If the cost of one procurement is Rs. 150, find :**

i. Economic order quantity,

ii. Numbers of order per year,

iii. The optimal cost.

AKTU 2016-17, Marks 7.5

Answer

Given : D = 3200 parts, Unit cost = Rs. 6, Holding cost per unit = 25 %, S = Rs. 150

1. Holding cost = Unit cost × Holding cost per unit
   = 6 × 0.25 = 1.5
2. $$EOQ = \sqrt{\frac{2DS}{H}}$$
   $$EOQ = \sqrt{\frac{2 \times 3200 \times 150}{1.5}} = 800$$
3. Number of order per year = Annual demand / EOQ
   = 3200 / 800 = 4
4. Optimal cost
   $= 6D + \sqrt{2DSH}$
   $= 6 \times 3200 + \sqrt{2 \times 3200 \times 150 \times 1.5}$
   = 19200 + 1200
   = Rs. 20400

Que 3.22. **Mention the importance of EOQ for any organization.**

AKTU 2017-18, Marks 10

Answer

Importance

a. Minimizes S

1. Storing inven
2. The main a recommendat units per orde
3. The model ma advantage of
4. Alternatively holding costs

b. Specific to t

1. Maintaining s balancing act
2. Another advar particular to t to re-order it
3. This smoothes service as inve

Que 3.23. **Exp**

techniques.

Explain the diffe

Answer

Various types

i. ABC analysis

1. ABC analysis i quantity of con
2. In ABC (Alway category consis but are very ex
3. The items in *B* compared to *A* moderate so cor
4. The *C* category require lesser ir

Answer

Importance of EOQ for any Organization :

a. Minimizes Storage and Holding Costs :

1. Storing inventory may be expensive for business owners.
2. The main advantage of the EOQ model is the customized recommendations provided regarding the most economical number of units per order.
3. The model may suggest buying a larger quantity in fewer orders to take advantage of discount bulk buying and minimizing order costs.
4. Alternatively, it may point to more orders of fewer items to minimize holding costs if they are high and ordering costs are relatively low.

b. Specific to the Business :

1. Maintaining sufficient inventory levels to match customer demand is a balancing act for many businesses.
2. Another advantage of the EOQ model is that it provides specific numbers particular to the business regarding how much inventory to hold, when to re-order it and how many items to order.
3. This smoothes out the re-stocking process and results in better customer service as inventory is available when needed.

Que 3.23. Explain the various types of inventory control techniques.

AKTU 2016-17, Marks 10

OR

Explain the different types of inventory control techniques.

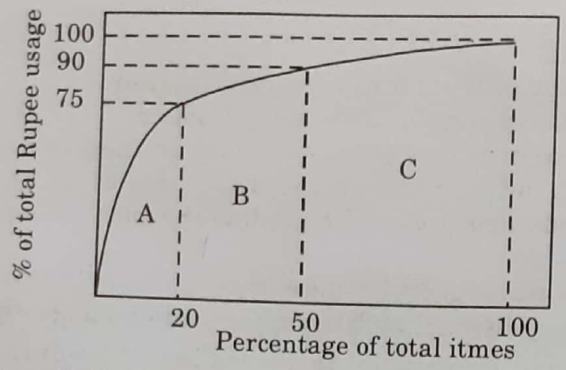
AKTU 2017-18, Marks 10

Answer

Various types of inventory control techniques are :

i. ABC analysis :

1. ABC analysis is a way of categorizing the material on the basis of the quantity of consumption and their relative values.
2. In ABC (Always Better Control) inventory management technique A category consists of high-priced inventory which may be less in number but are very expensive.
3. The items in *B* category are relatively lesser expensive inventory as compared to *A* category and the number of items in *B* category is moderate so control level is also moderate.
4. The *C* category consists of a high number of inventory items which require lesser investments so the control level is minimum.



ii. Just In Time (JIT) Method :

1. In just in time method of inventory control, the company keeps only as much inventory as it needs during the production process.
2. With no excess inventory in hand, the company saves the cost of storage and insurance.
3. The company orders further inventory when the old stock of inventory is close to replenishment.
4. This method requires proper planning so that new orders can be timely placed.

iii. Material Requirements Planning (MRP) Method :

1. MRP system integrates data from various areas of the business where inventory is utilized.
2. Based on the data and demand in the market, order for new inventory is placed with the material suppliers.

iv. Economic Order Quantity (EOQ) Model :

1. Economic Order Quantity technique focuses on taking a decision regarding how much quantity of inventory should the company order at any point of time and when should they place the order.
2. In this model, inventory is reordered when it reaches the minimum level.
3. EOQ model helps to save the ordering cost and carrying costs incurred while placing the order.

v. Minimum Safety Stocks :

1. The minimum safety stock is the level of inventory which an organization maintains to avoid stock out situation.
2. It is the level at which the new order is placed before the existing inventory is over.

vi. VED Analysis :

1. VED analysis attempts to classify the items used into three broad categories namely, Vital, Essential, and Desirable.
2. The analysis classifies items on the basis of their criticality for the industry or company.

3. **Vital :** Vital category items are those items without which the production activities or any other activity of the company, would come to a halt, or at least be drastically affected.
4. **Essential :** Essential items are those items whose stock - out cost is very high for the company.
5. **Desirable :** Desirable items are those items whose stock-out or shortage causes only a minor disruption for a short duration in the production schedule. The cost incurred is very nominal.
6. VED analysis is very useful to categorize items of spare parts and components

vii. Fast, Slow and Non-Moving (FSN) Method :

1. All the items of inventory are not used in the same order; some are required frequently, while some are not required at all.
2. So this method classifies inventory into three categories, fast moving inventory, slow-moving inventory and non-moving inventory.
3. The order for new inventory is placed based on the utilization of inventory.

Que 3.24. What is ABC analysis ? What are its advantages and disadvantages ?

Answer

A. ABC Analysis : Refer Q. 3.23, Page 3–22Y, Unit-3.

B. Advantages of ABC analysis :

1. **Reduction in Investment :** Under ABC analysis, the materials from group 'A' are purchase in lower quantities as much as possible. With this, the effort to reduce the delivery period is also made. These in turn help to reduce the investment in material.
2. **Strict Control :** Under ABC analysis, strict control can be exercised to the materials in group 'A' that have higher value.
3. **Minimum Storage Cost :** Since, the material from group 'A' are purchase in lower quantities as much as possible, it reduce the storage cost as well.
4. **Saving in Time :** Since a signification effort is made for management of the material from group 'A', it helps to save time as well.
5. **Economy :** This method is economical, since equal time and labour is not needed for all types of materials.

C. Disadvantage of ABC Analysis :

1. ABC analysis will not be effective if the materials are not classified into the groups properly.
2. It is not suitable for the organization where the costs of materials do not vary significantly.
3. There is no scientific base for the classification of material under ABC analysis.
4. The classification of the materials into different groups may lead to extra cost. Hence, it may not be suitable for small organization.

Que 3.25. **Brief any one method of inventory management.**

AKTU 2013-14, Marks 10

Answer

Refer Q. 3.23, Page 3–22Y and Q. 3.24, Page 3–24Y, Unit-3.

Que 3.26. **Describe the basic model of inventory control with its assumptions.**

AKTU 2016-17, Marks 10

Answer

A. **Basic Model of Inventory Control :** Refer Q. 3.19, Page 3–18Y, Unit-3.

B. **Assumption for EOQ Model :** Following are the assumptions for the EOQ model.

1. The cost of the ordering remains constant.
2. The demand rate for the year is known and evenly spread throughout the year.
3. The lead time is not fluctuating (lead time is the latency time it takes a process to initiate and complete).
4. No cash or settlement discounts are available, and the purchase price is constant for every item.
5. The optimal plan is calculated for only one product.
6. There is no delay in the replenishment of the stock, and the order is delivered in the quantity that was demanded, *i.e.*, in whole batch.

If basic assumptions of the model are met, the graph of inventory consumption and restocking looks as follows :

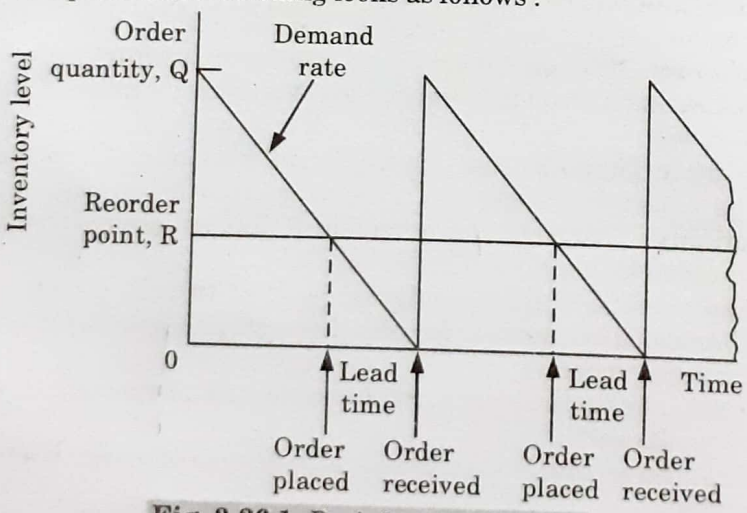


Fig. 3.26.1. Basic inventory model.

☺☺☺

4 UNIT

Part-1 : Q
Part-2 : C
Part-3 : A
Part-4 : In

4 UNIT

Quality Control

CONTENTS

PART-1

Quality Control.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 4.1. Define quality control. What are the objectives and significance of quality control ?

Answer

A. Quality control is the set of measures and procedures to follow in order to ensure that the quality of a product is maintained and improved against a set of benchmarks and any errors encountered are either eliminated or reduced.

B. Objectives of quality control : Following are the important objectives of quality control :

1. To establish the desired quality standards which are acceptable to the customer.
2. To discover flaws or variations in the raw materials and the manufacturing processes in order to ensure smooth and uninterrupted production.
3. To evaluate the methods and processes of production and suggest further improvements in their functioning.
4. To study and determine the extent of quality deviation in a product during the manufacturing process.
5. To analyse in detail the causes responsible for such deviation.
6. To undertake such steps which are helpful in achieving the desired quality of the products.

C. Significance of quality control :

1. Detects Quality Deviation
2. Acceptance by customers
3. Earns goodwill
4. Develops Quality Consciousness
5. Timely delivery of goods
6. Improves productivity
7. Motivates employees

Que 4.2. Give a brief description of statistical quality control.

AKTU 2013-14, Marks 10

OR

What is SQC ?

Answer

1. Statistical Quality Control (SQC) refers to the use of statistical methods in monitoring and maintaining the quality of products and services.
2. SQC uses following different tools to analyze quality problem :

i. **Descriptive statistics :** Descriptive statistics involves in describing quality, characteristics and relationships.

ii. **Statistical Process Control (SPC) :** SPC involves in inspecting random sample of output from process for characteristic.

iii. **Acceptance sampling :** Acceptance sampling involves batch sampling by inspection.

3. All the tools of SQC are helpful in evaluating the quality of services.

Techniques of statistical quality control :

1. The important techniques used for statistical quality control can be broadly classified into two categories: Statistical Process Control (SPC) (or Process Control) and Product Control.
2. These techniques are further classified into different categories as shown in Fig. 4.2.1.

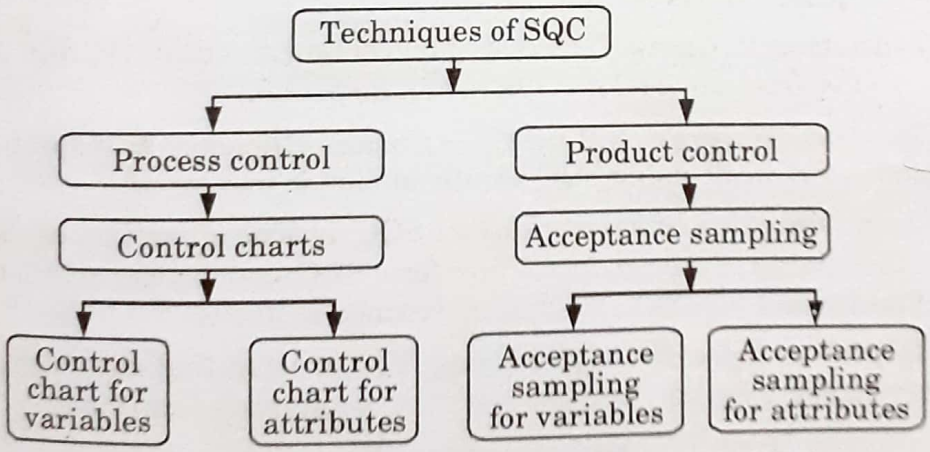


Fig. 4.2.1. Classification of SQC techniques.

Statistical Process Control (SPC) : Statistical process control is a technique used for understanding and monitoring the process by collecting data on quality characteristics periodically from the process and analyze them and take suitable actions whenever there is a difference between actual quality and the specifications or standard.

Product Control : Product control means to control the products in such a way that these are free from defects and conform to their specifications.

Objectives of SQC :

1. It provides a means of detecting error at inspection.
2. It leads to more uniform quality of production.
3. It improves the relationship with the customer.
4. It reduces inspection costs.
5. It reduces the number of rejects and saves the cost of material.
6. It provides a basis for attainable specifications.
7. It points out the bottlenecks and trouble spots.
8. It provides a means of determining the capability of the manufacturing process.
9. It promotes the understanding and appreciation of quality control.

Que 4.3. What are the advantages and limitations of statistical quality control ? **AKTU 2015-16, Marks 7.5**

Answer

A. Advantages of SQC :

1. **Ease of Application :** Statistical quality control is easy to apply. Even those persons who have not had extensive specialised training can apply statistical methods easily.
2. **Reduction in Costs :** The cost of inspection is reduced in SQC as only a part or fraction of a lot is taken and inspected.
3. **Greater Efficiency :** It provides greater efficiency as inspectors are more alert while using SQC as only of part is inspected.
4. **Early Detection of Faulty Units :** SQC consists of continuous checking of the quality of the product. Therefore, SQC ensures an early detection of faults and results in minimum wastage of items.
5. **Helpful in Specification :** Using SQC, we can find out whether the item meets the specifications within the tolerance limits or not.
6. **Ensures Overall Coordination :** SQC methods ensure coordination between managers managing specifications, production and inspection.
7. **Determination of the Effect of Change in the Process :** With the help of control charts, we can easily detect whether or not a change in the production process results in a significant change in the quality.
8. **Equilibrium in Consumer's and Producer's Risk :** Methods such as quality control and acceptance sampling help in maintaining equilibrium between the consumer's risk and producer's risk.

9. **Wider Applications :** It is not only useful in the examination of items produced in small numbers, but also when bulk production has to be done.

B. Limitations of SQC :

1. When a sample of the items drawn from the lot is not a true representative of the entire lot and does not have the same characteristics as the lot from which it is drawn. Then a good lot may be rejected and a bad one may be accepted. This is the main limitation of SQC.
2. SQC is cannot be used mechanically for any production process without studying the process and without having adequate knowledge about the process.
3. SQC applied on a production process provides only the information that the process is under control or out-of-control. It cannot take any action for improvement.

PART-2

Control Charts.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 4.4. What is a control chart ? Discuss the types of control charts for 'variables' (mean chart and range chart).

AKTU 2016-17, Marks 7.5

AKTU 2017-18, Marks 10

OR

Define control charts. Explain various charts briefly.

Answer

1. Control chart is a graph used to study how a process changes over time.
2. Data are plotted in time order.
3. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit.

Basic procedure for control chart :

i. Choose the appropriate control chart for given data.

ii. Determine the appropriate time period for collecting and plotting data.

iii. Collect data, construct the chart and analyze the data.

iv. Look for out-of-control signals on the control chart and if it is identified, mark it on the chart and investigate the cause.

Types of control charts :

1. **Variable charts :** Variable data are quantitative data that can be measured. **Example :** The diameter of a bearing, the thickness of newly minted coin or length of a screw.
2. **Attributes charts :** Attributes data are qualitative data that can be counted. **Example :** Surface finish of a product, count of scratches per item or brightness of an item.

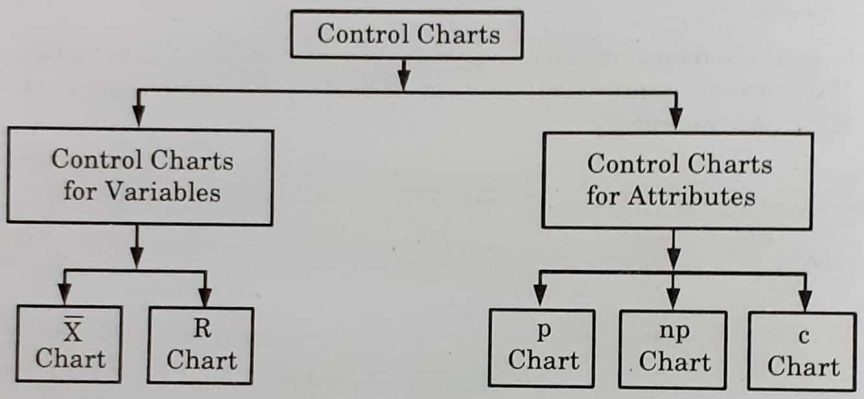


Fig. 4.4.1.

Types of variable control charts :

1. **$\bar{X}$-Chart or mean Chart :** $\bar{X}$-chart is a variable control chart that is used to monitor the arithmetic means of successive samples of constant size. This type of control chart is used for characteristics that can be measured on a continuous scale, such as weight, temperature, thickness etc.,
2. ***R*-Chart or Range Chart :** In statistical quality control, *R*-chart is used when the quality controller is interested in the range or difference between the largest and smallest measurements.

Types of attribute control charts :

1. ***p*-Chart (For Fraction Defective) :** In this chart, each item is classified as good (non-defective) or bad (defective). This chart is used to control the general quality of the component parts. *p*-chart is used to plot and control fraction defectives when the sample size remains uniform or it varies.
2. ***np*-Chart (For Number of Defectives) :** A *np*-chart is appropriate when the numbers of items used to calculate each proportion is same. For example, 100 reports may be reviewed each week and categorized as either accurate or inaccurate. The proportion of inaccurate reports could be plotted on a *p*-chart or the actual number of inaccurate reports

could be plotted on an *np*-chart. If the number of reports reviewed each week varies, then a *p*-chart must be used.

3. ***c*-Chart (For Number of Defects per unit) :** *c*-chart is used to records the number of defects founds in a given sample size. This chart is used where average number of defects is much less than the number of defects which would occur.

Que 4.5. What are the advantages of attribute and variable control charts ?

Answer

A. Advantages of attribute control charts :

1. Allowing for quick summaries, that is, the engineer may simply classify products as acceptable or unacceptable, based on various quality criteria.
2. Thus, attribute charts sometimes bypass the need for expensive, precise devices and time consuming measurement procedures.
3. More easily understood by managers who are not familiar with quality control procedures.

B. Advantages of variable control charts :

1. More sensitive than attribute control charts.
2. Variable control charts may alert us to quality problems before any actual "unacceptable" (as detected by the attribute chart) will occur.
3. Variable control charts are leading indicators of trouble that will sound an alarm before the number of rejects increases in the production process.

Que 4.6. Discuss the need, construction and applications of control charts for variables. **AKTU 2015-16, Marks 10**

Answer

A. Control Charts for Variables :

1. Control charts for variable are used to achieve and maintain an acceptable quality level for a process.
2. Variables control charts plot continuous measurement process data, such as length or pressure, in a time-ordered sequence.
3. Variables control charts, like all control charts, help us to identify the causes of variation to investigate, so that we can adjust our process without over-controlling it.

B. Construction of charts :

The $\bar{X}$ (arithmetic mean) and R (range) control chart is used with variables data. The steps for constructing this type of control chart are :

Step 1 : Determine the data to be collected. Decide what questions about the process you plan to answer.

Step 2 : Collect and enter the data by subgroup. The sample size relates to how large the subgroups are. Enter the individual subgroup measurements in time sequence in the portion of the data collection section of the control chart labelled measurement.

Sept 3 : Calculate and enter the average for each subgroup. Use the formula to calculate the average (mean) for each subgroup and enter it on the line labelled Average in the data collection section.

Step 4 : Calculate and enter the range for each subgroup. Enter the range for each subgroup on the line labelled Range in the data collection section.

Range = (Largest value in each subgroup) – (Smallest value in each subgroup)

Step 5 : Calculate the grand mean of the subgroup's average. The grand mean of the subgroup's average $\bar{X}$ becomes the centreline for the upper plot.

Step 6 : Calculate the average of the subgroup ranges. The average of all subgroups becomes the centreline for the lower plotting area.

Step 7 : Calculate the upper control limit (UCL) and lower control limit (LCL) for the averages of the subgroups.

Step 8 : Calculate the upper control limit for the ranges.

Step 9 : Select the scales and plot the control limits, centreline, and data points, in each plotting area.

Step 10 : Document the chart.

C. Applications :

i. To monitor a process for those special causes of variation that can occur and remove them so they don't occur again.

ii. To estimate the process average. Another purpose is to estimate the variation.

ii. To judge the impact of process improvement efforts.

Que 4.7. Describe the method of constructing variable charts and attribute charts. And explain how these charts help in determining "Lack of Control". **AKTU 2017-18, Marks 10**

Answer

A. Method of constructing variable charts : Refer Q. 4.6, Page 4–7Y, Unit-4.

B. Method of constructing attribute charts :

1. *p*-chart (proportion chart) :

When to Use :

i. Sample sizes are NOT equal.

ii. Have discrete data.

Step 1 : Measure $\bar{p}$:

$\bar{p}$ = Fraction rejected

= Total defectives / Total inspected.

Step 2 : Find Control Limits :

$$3\,SD = 3 \times \sqrt{\frac{\bar{p}\,(1-\bar{p})}{n}}$$

n refers to a single instance of a sample size, not the number of sample sizes (or rows) listed. Since there are multiple sample sizes, we use the largest one on the list.

Upper control limit = $\bar{p} + 3\,SD$

Lower control limit = $\bar{p} - 3\,SD$

2. *np*-chart :

When to Use :

i. Sample sizes are equal.

ii. Subgroups are the same size.

iii. Attributes are discrete and binary (Example : yes vs. no; up vs. down)

Step 1 : Calculate $\bar{p}$ as above.

Step 2 : Calculate $n\bar{p}$.

$n\bar{p}$ = Total number of defective / Total samples.

The total samples are the number of rows listed.

Step 3 : Calculate the control limits

$$UCL = n\bar{p} + 3\sqrt{n\bar{p}\,(1-\bar{p})}$$

$$LCL = n\bar{p} - 3\sqrt{n\bar{p}\,(1-\bar{p})}$$

3. *c*-charts :

When to Use :

i. Total opportunity population is large compared to number of defects.

ii. When you cannot count "not a defect."

iii. Data type is discrete but each count has an equal opportunity of coming up.

Step 1 : c = Total number of defects / Number of units

Step 2 : $UCL = \bar{c} + 3\sqrt{c}$

$LCL = \bar{c} - 3\sqrt{c}$

Now, we interpret the result. If all sample points lie on or in between the upper and lower control limits, the control chart indicates that the process is under control. If one or more points lie outside the upper or lower control limits, the control chart indicates that the process is not under statistical control (Lack of control) and some assignable causes are present in the process.

Que 4.8. **What do you understand by process control ? Define control chart and give the objectives of $\bar{X}$ and R charts.**

AKTU 2014-15, Marks 10

Answer

A. Process Control : Process control is activities involved in ensuring a process is predictable, stable, and consistently operating at the target level of performance with only normal variation.

B. Control chart : Refer Q. 4.6, Page 4–7Y, Unit-4.

C. Objectives of $\bar{X}$ and R charts : Refer Q. 4.4, Page 4–5Y, Unit-4.

Que 4.9. **Differentiate between $\bar{X}$ -R chart and p-chart.**

Answer

S. No.	$\bar{X}$ -R chart	p-chart
1.	These are control charts for variables.	These are control charts of attributes.
2.	Cost of data collection is higher due to actual dimensional measurements.	Data collection is comparatively cheaper.
3.	Sample sizes are relatively small.	Larger size samples are to be taken.
4.	The control limits are affected by sample size.	There is less effect of the sample size over control limits.
5.	For different measurable quality characteristics different charts are to be drawn.	Same p-chart may be applied to any one item under inspection.
6.	This method is much superior in diagnosing the cause of variability.	This method is comparatively inferior regarding diagnosing the causes of rejections.

PART-3

Acceptance Sampling.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 4.10. What do you understand by acceptance sampling ? What are its advantages and limitations ?

Answer

A. Definition : A sampling inspection in which a decision about acceptance or rejection of a lot is based on one or more samples that have been inspected is known as acceptance sampling.

Acceptance sampling is a technique in which a small part or a fraction of the units/items is selected randomly from a lot and the selected units are inspected to decide whether the lot should be accepted or rejected on the basis of the information provided by the sample inspection.

B. For example : Suppose a manufacturer of cricket balls supplies them in lots of 500. A buyer wants to inspect 20 balls from each lot before accepting the lot and takes a decision about acceptance or rejection of the lot on the basis of the information provided by this sample. This is an example of acceptance sampling because the decision about the lot is taken on the basis of a sample.

C. Advantages of acceptance sampling :

i. It is less expensive in terms of money, time and labour in comparison to 100 % inspection.

ii. For items, which cannot be used after single inspection, such as crackers, bulbs, tube lights, food, etc., 100 % inspection is not practicable. Sampling inspection is the only way for inspecting such items.

iii. In acceptance sampling, a sample of a small number of items or units is inspected and hence smaller inspection staff is required.

iv. Due to quick inspection through the acceptance sampling, the scheduling and delivery times are saved.

D. Limitations of acceptance sampling :

i. Since, in acceptance sampling, the entire lot is accepted or rejected on the basis of conclusions drawn from one or more samples, there is always some risk of making wrong inference about the quality of the lot.

ii. The success of acceptance sampling depends on the randomness of the sample, quality characteristics to be tested, lot size, acceptance criteria, etc. Therefore, it is a specialised job requiring careful planning and execution and every one cannot undertake it.

Que 4.11. What is single sampling plan ? Describe the single sampling procedure.

Answer

A. **Definition :** A sampling plan in which a decision about the acceptance or rejection of a lot is based on a single sample that has been inspected is known as a single sampling plan.

B. **For example :** Suppose a buyer purchases cricket balls in lots of 500 from a company manufacturing cricket balls. To check the quality of the lots, the buyer draws a random sample of size 20 from each lot and takes a decision about accepting or rejecting of the lot on the basis of the information provided by this sample. Since the buyer takes the decision about the lot on the basis of a single sample, this sampling plan is a single sampling plan.

C. **Parameters :** There are two parameters :

n-size of the sample, and

c-acceptance number for the sample.

D. **Procedure :** The procedure for implementing the single sampling plan to arrive at a decision about the lot is described in the following steps:

Step 1 : We draw a random sample of size n from the lot received from the supplier or the final assembly.

Step 2 : We inspect each and every unit of the sample and classify it as defective or non-defective. At the end of the inspection, we count the number of defective units found in the sample. Suppose the number of defective units found in the sample is d.

Step 3 : We compare the number of defective units (d) found in the sample with the stated acceptance number (c).

Step 4 : We take the decision of acceptance or rejection of the lot on the basis of the sample.

Que 4.12. What is double sampling plan ? Describe the procedure of double sampling plan.

Answer

A. **Definition :** A sampling plan in which a decision about the acceptance or rejection of a lot is based on two samples that have been inspected is known as a double sampling plan.

B. For example : Suppose a buyer purchases cricket balls in lots of 500 from a company. To check the quality of the lots, the buyer and the company decide that the buyer will draw two samples of sizes 10 (first sample) and 20 (second sample) and the acceptance numbers for the plan are 1 and 3. The buyer takes two samples and makes the decision of acceptance or rejection of the lot on the basis of two samples.

C. Parameters : There are four parameters :

n_1 size of the first sample,

c_1 acceptance number for the first sample,

n_2 size of the second sample, and

c_2 acceptance numbers for both samples combined.

D. Procedure : The procedure for implementing the double sampling plan to arrive at a decision about the lot is described in the following steps :

Step 1 : We draw a random sample (first sample) of size n_1 from the lot received from the supplier or the final assembly.

Step 2 : We inspect each and every unit of the sample and classify it as defective or non-defective. At the end of the inspection, we count the number of defective units found in the sample. Suppose the number of defective units found in the first sample is d_1.

Step 3 : We compare the number of defective units (d_1) found in the first sample with the stated acceptance numbers c_1 and c_2.

Step 4 : We take the decision on the basis of the first sample as follows :

If $d_1 \leq c_1$, sample is accepted

If $d_1 > c_2$, sample is rejected

Step 5 : If $c_1 < d_1 \leq c_2$, we draw a second random sample of size n_2 from the lot.

Step 6 : We inspect each and every unit of the second sample and count the number of defective units found in it. Suppose the number of defective units found in the second sample is d_2.

Step 7 : We combine the number of defective units (d_1 and d_2) found in both samples and consider $d_1 + d_2$ for taking the decision about the lot on the basis of the second sample as follows:

If $d_1 + d_2 \leq c_2$, sample is accepted

If $d_1 + d_2 > c_2$, sample is rejected.

Que 4.13. Write short note on sequential sampling plan.

Answer

1. The sequential-sampling plan is refinement of the double sampling plan, in which we randomly selects items from the lot and inspects them one by one.

2. Each time an item is inspected, a decision is made to (1) reject the lot, (2) accept the lot, or (3) continue sampling, based on the cumulative results so far.
3. We count the total number of defectives against the cumulative sample size, and if the number of defectives is less than a certain acceptance number (c_1), the lot is accepted.
4. If the number is greater than another acceptance number (c_2), the lot is rejected.
5. If the number is somewhere between the two, another item is inspected.

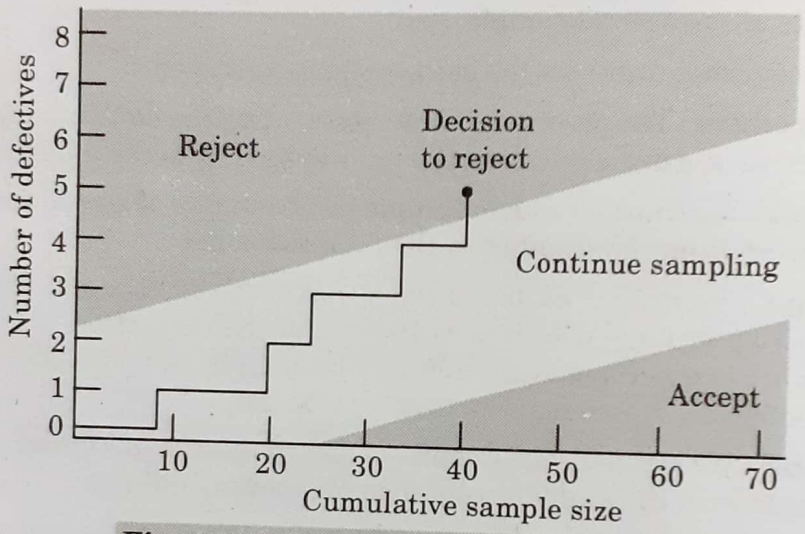


Fig. 4.13.1. Sequential sampling chart.

Fig. 4.13.1, illustrates a decision to reject a lot after examining the 40th unit. Such charts can be easily designed with the help of statistical tables that specify accept or reject cut-off values c_1 and c_2 as a function of the cumulative sample size.

Que 4.14. What do you understand by acceptance sampling ? Explain the methods of double sampling and sequential acceptance sampling.

AKTU 2014-15, Marks 10

OR

What is acceptance sampling ? Describe the single, double and sequential sampling procedures.

AKTU 2016-17, 2017-18; Marks 10

Answer

Acceptance sampling : Refer Q. 4.10, Page 4–11Y, Unit-4.

1. **Single sampling plan :** Refer Q. 4.11, Page 4–12Y, Unit-4.
2. **Double sampling plan :** Refer Q. 4.12, Page 4–12Y, Unit-4.
3. **Sequential sampling plan :** Refer Q. 4.13, Page 4–13Y, Unit-4.

PART-4

Introduction to TQM.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 4.15. What is Total Quality Management ? Why is it important for engineering organisations ? **AKTU 2013-14, Marks 10**

OR

Write short note on Total Quality Management. **AKTU 2013-14, Marks 05**

Answer

1. Total Quality Management, abbreviated as TQM is a people-oriented management system, wherein all the members of the organization, makes continuous efforts so as to maintain high work standards, in all the operations of the company.
2. Its main aim is to make a continuous increase in the customer loyalty and satisfaction, at constantly lower cost.

Phases of Total Quality Management :

Planning Phase : In this phase, the employees are required to discover the problems faced by them, during regular operations along with their root-cause. For this, a comprehensive research is done by the employees to collect the relevant data, with a view to finding solutions to their problems.

Doing Phase : At this stage, employees find out solutions to their problems, stated in the previous stage. Strategies are created and executed to cope with the problems experienced by the employees, while at work. Moreover, the evaluation of the usefulness of strategies and solutions are also done in this phase.

Checking Phase : The performance is analysed by making a comparison of before and after data, for validating the effectiveness of the processes and measuring the outcome.

Acting Phase : The outcome of the process is documented at this stage, and the employees prepare themselves to confront other challenges.

Principles of Total Quality Management : There are a few principles, which guide the success of total quality management, described as under :

1. Long-term management commitment to quality
2. Customer-focused
3. Preventing, and not detecting defects
4. Universal quality responsibility
5. Measurement of quality
6. Process-centered
7. Constant refinement and learning
8. Statistical thinking
9. Value improvement
10. Synergy of teams
11. Training

Benefits of Total Quality Management :

1. This will increase the awareness of quality culture within the organization.
2. A special emphasis on team work will be achieved.
3. TQM will lead to a commitment towards continuous improvement.

Que 4.16. Explain total quality management. Discuss various statistical tools used for quality control and improvement.

AKTU 2017-18, Marks 10

Answer

A. TQM : Refer Q. 4.15, Page 4–15Y, Unit-4.

B. There are several types of tools that can be used for quality control and improvement. However, there are seven management tools for quality control that are the most common.

1. **Stratification :** A technique that separates data gathered from a variety of sources so that patterns can be seen (some lists replace "stratification" with "flowchart" or "run chart").
2. **Check sheet :** A structured, prepared form for collecting and analyzing data; a generic tool that can be adapted for a wide variety of purposes.
3. **Cause-and-effect diagram (Ishikawa or fishbone chart) :** Identifies many possible causes for an effect or problem and sorts ideas into useful categories.
4. **Pareto chart :** Shows on a bar graph which factors are more significant.
5. **Control charts :** Graphs used to study how a process changes over time. Comparing current data to historical control limits leads to conclusions about whether the process variation is consistent (in control) or is unpredictable (out of control, affected by special causes of variation).

6. **Histogra** distributi
7. **Scatter** each axis

Que 4.17.

and Total Q

Explain th quality ma

Answer

Definit object w

S. No.	To
1.	TQ org ma
2.	TQ thr pr ma de
3.	TQ te wo th qu bu
4.	To fo bu qu
5.	It in m

6. **Histogram :** The most commonly used graph for showing frequency distributions, or how often each different value in a set of data occurs.
7. **Scatter diagram :** Graphs pairs of numerical data, one variable on each axis, to look for a relationship.

Que 4.17. **Define Quality. What is the difference between Quality and Total Quality Management ?** **AKTU 2014-15, Marks 10**

OR

Explain the difference between quality management and total quality management. **AKTU 2015-16, Marks 10**

Answer

Definition of quality : Quality is the degree of perfectness of the object with respect to the standard.

S. No.	Total Quality Management	Quality Management
1.	TQM is managing the whole organization in an efficient manner, to achieve excellence.	Quality management is concerned with defect detection by using post production inspection procedure.
2.	TQM is managing quality through the whole process of production, including management and all the other departments.	Main focus is on the product *i.e.*, what is wrong with the product.
3.	TQM is a management technique that empowers the workforce to produce a product that meets and improves the quality objectives of the business naturally.	In quality management the extent of employee involvement is minimal.
4.	Total quality management is focused on the organization/ business to adopt the culture of quality.	Quality management is focused on product/service quality and the means to achieve it.
5.	It takes three to five years to install a total quality management system.	It takes a real short time to install a quality management system.

☺☺☺

5
UNIT

Project Management

CONTENTS

PART-1

Project Management.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.1. **Define project management. Why it is important ?**

Answer

A. Project Management : It is the practice of initiating, planning, executing, controlling and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time.

B. Importance of Project Management :

1. Project management is important because it ensures proper expectations are set around what can be delivered, by when, and for how much.
2. Effective project managers should be able to negotiate reasonable and achievable deadlines and milestones across stakeholders, teams, and management.
3. The importance of project management is an important topic because all organisations, be it small or large at one time or other are involved in implementing new undertakings.
4. These undertakings may be diverse such as the development of a new product or service; the establishment of a new production line in a manufacturing enterprise; a public relations promotion campaign; or a major building programme.

Que 5.2. **What are the various stages in the total life cycle of a project ? Explain with suitable diagram.**

Answer

The project management context contains two elements :

A. Project Life Cycle :

1. The sequence of phases through which the project will evolve is known as project life cycle.
2. In simple words, a project life cycle is basically defined by its phases, according to which a project swims through and finally reaches to handover stage.
3. The phases in project life cycle are as :

a. Phase 1 : Start up / Conceptualization of Project :

It contains the following keywords :

i. Purpose,
ii. Strategic fit,
iii. Objective,
iv. Scope,
v. Terms of reference, and
vi. Draft schedule.

b. Phase 2 : Planning of Project Activities and Resources :

It contains following keywords :

i. Scope,
ii. Select team members,
iii. Plan delivery,
iv. Quality plan,
v. Baseline schedule,
vi. Baseline budget,
vii. Risk analysis,
viii. Issue register,
ix. Approvals, and
x. Communication plan.

c. Phase 3 : Execution of Project :

It contains following keywords :

i. Production of key deliverables,
ii. Monitor / control,
iii. Quality management,
iv. Cost management,
v. Risk management,

vi. Issue resolution, and

vii. Change control reporting.

d. Phase 4 : Termination of Project :

It contains following keywords :

i. Contract close out,

ii. Team feedback,

iii. Recommendation for further action, and

iv. Post implementation review.

4. The level of activity required during project life cycle will vary with time.

5. This can be illustrated by project life cycle curve as shown in Fig. 5.2.1.

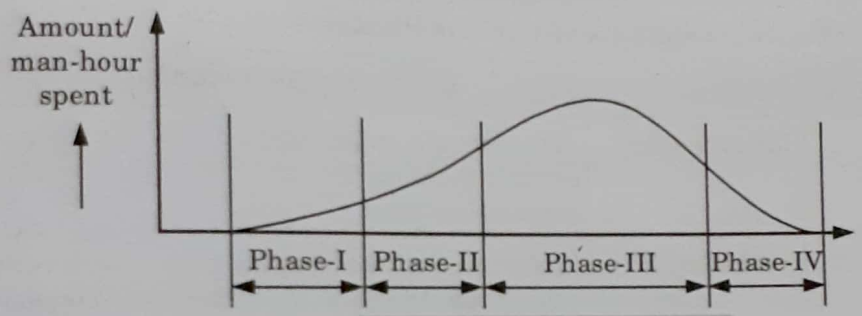


Fig. 5.2.1. Project life cycle.

6. The level of activity is relatively low during the early phases, increases through the implementation stage where the major volume of work is done.

7. This pattern is shown as a group of cumulative expenditure against time in Fig. 5.2.2.

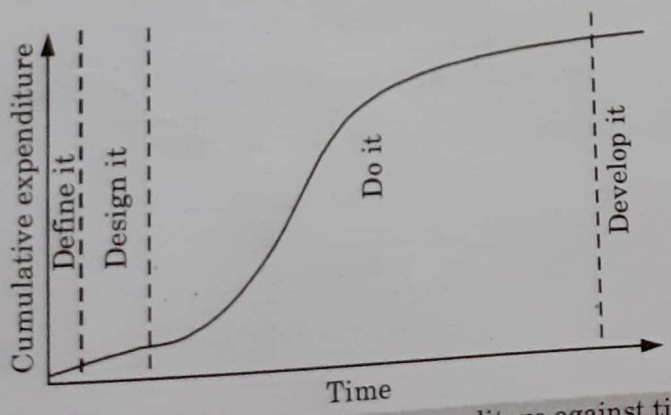


Fig. 5.2.2. Graph of cumulative expenditure against time.

Que 5.3. Describe the phases and requirement of various phases of project management.

Answer

A. Phases of Project Management :

1. The process of project management may be divided into six broad phases as shown in Fig 5.3.1.

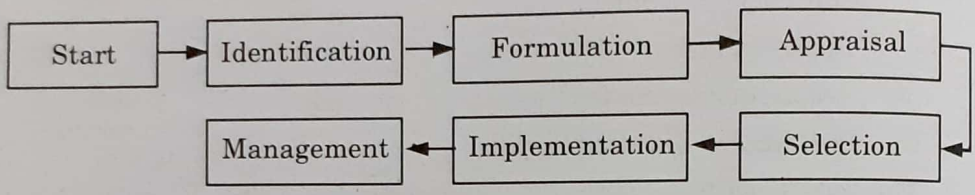


Fig. 5.3.1. Phases of project management.

B. The Requirements of Various Phases :

S. No.	Phase	Requirements
1.	Identification	Selection of a project after sound scanning of the environment of investment opportunity and potential returns.
2.	Formulation	Translation of the project idea into a concrete project by analysis of important parameters. Preparation of feasibility report.
3.	Appraisal	Analysis and evaluation of market, technology, financial and economic parameters break-even analysis, rate of return and profitability assessment.
4.	Selection	Project selection based on objectives and constraints.
5.	Implementation	Project completion within allotted resources.
6.	Management	Operation of enterprise with maximization of returns.

PART-2

Project Network Analysis.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.4. Defi
importance and

Answer

A. Project Net

1. The network diagram, wh various links
2. The network graph theory

B. Importanc

1. A project ha be analyzed of the projec
2. Network ar total mainte

C. Objectives of network

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ii. To Minimi be calculate calculating in addition various spe

iii. To Trade off betwee of same act them.

iv. To Minim is achieve precedenc

Que 5.5.
disadvantage

Answer

A. Network the relatio create kn

B. Advanta

1. A logical
2. The critic can be co

Que 5.4. **Define project network analysis in brief. Also, give its importance and objectives.**

Answer

A. Project Network Analysis :

1. The network analysis methods are related to the concept of network diagram, which is a view of the project as a diagram which expresses various links between the project activities.
2. The network diagrams and network analysis methods are based on the graph theory.

B. Importance of Network Analysis / Network Technique :

1. A project has divided into many small activities and these activities can be analyzed with the help of network technique to achieve the objectives of the project.
2. Network analysis helps management to minimize the total cost and total maintenance time.

C. Objectives of Network Analysis : Followings are the main objectives of network analysis :

i. **To Minimize Idle Resources :** Allowing for large variations in the use of limited resources may disturb the whole plan. Thus, efforts should be made to avoid the cost incurred due to idle resources.

ii. **To Minimize the Total Project Cost :** The total cost of the project can be calculated and then efforts can be made to minimize the total cost by calculating the cost of delay in the completion of an activity of the project in addition to the cost of the resources required to carry out the jobs at various speeds (*i.e.*, normal or over time rates of pay).

iii. **To Trade Off between Time and Cost of Project :** The idea of trade off between time and cost of project is centered on the idea that duration of same activities can be cut down if additional resources are allocated to them.

iv. **To Minimize Production Delays, Interruption and Conflict :** This is achieved by identifying all activities involved in the project, their precedence constraints, etc.

Que 5.5. **Discuss network along with advantages and disadvantages of network analysis.**

Answer

A. Network : A network signifies a number of people and resources, and the relationships between them, that are able to capture, transfer and create knowledge for the purpose of creating value.

B. Advantages of Network Analysis :

1. A logical planning of whole project is ensured.
2. The critical activities are identified and rate of progress of the project can be controlled.

3. Helps management to plan alternative ways of optimization of direct and indirect costs to achieve minimum total cost.

C. Disadvantages of Network Analysis :

1. Limited to evaluation interactions.
2. Requires multiple software UCINET for analysis, Netdraw for network maps.

PART-3

CPM, PERT.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.6. Discuss PERT and CPM with their advantages and disadvantages.

Answer

A. PERT :

1. The main object in the analysis through PERT is to find out the completion for a particular event within specified date. If yes, what are the chances of completing the job ?
2. The PERT approach takes uncertainties into the account.
3. In this approach, three different times are associated with each activity : The optimistic time, the pessimistic time, and the most likely time.
4. These three times provide a measure of uncertainty associated with that activity.

i. Advantages of PERT :

1. It is a very good management tool to plan the best use of resources possible to achieve a given goal within overall time and cost limits.
2. It helps the management to handle the uncertainties involved in project execution programs as no standard time data are available.
3. It helps to take right action, at the right point and at the right time.

ii. Disadvantages of PERT :

1. The activities involved in a project are non-repetitive. Therefore, it is very difficult to estimate time of completion of activities which are new.
2. The resources required at various stages of the project are not considered.

3. Frequent updati
for active contro

B. Critical Path Meth

1. CPM uses networkin
2. It is very widely used
   i. CPM uses two ti
   situation and th
   ii. The estimation
   iii. It works on the
   known time.

i. Advantages of CP

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3. It is a managem
4. It helps in bette

ii. Disadvantages of

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3. It is a static plan
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Que 5.7. Define cr
analysis.

Answer

A. Critical Path :

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to ending event and
project.
3. The critical path is
from the other non-
4. The critical path ha
   a. First, if the pr
   that path must
   b. The variation
   duration time
   the anticipated

3. Frequent updating and revision of PERT calculations are needed for active control of the project. This can be quite costly.

B. Critical Path Method (CPM) :

1. CPM uses networking principle for planning and controlling projects.
2. It is very widely used only next to PERT model :
   i. CPM uses two time-cost estimates for each activity, one for normal situation and the other for crash situation.
   ii. The estimation of time in CPM does not use any statistical analysis.
   iii. It works on the assumption that each activity will takes a precise known time.

i. Advantages of CPM :

1. It is used to schedule all types of large and small projects.
2. It helps in fixing the time schedule.
3. It is a management tool for easy control of project.
4. It helps in better and detailed planning.

ii. Disadvantages of CPM :

1. Statistical analysis is not used to estimate precise time.
2. It works on the assumption that each activity of the project will take a precise time for completion which may not be true in actual practice.
3. It is a static planning model and not a dynamic controlling technique. Whenever changes have to be incorporated in the network, whole of evaluation work of the project has to be repeated.

Que 5.7. Define critical path and its importance in network analysis.

Answer

A. Critical Path :

1. The sequence of critical activities in a network is called critical path.
2. The critical path is longest path in the network from the starting event to ending event and defines the minimum time required to complete the project.
3. The critical path is denoted by darker or double lines to distinguish it from the other non-critical paths.
4. The critical path has two principle features :
   a. First, if the project has to be shortened some of the activities on that path must be shortened.
   b. The variation in actual performance from the expected activity duration time will be completely reflected in one to one fashion in the anticipated completion of the whole project.

B. Importance of Critical Path in Network Analysis :

1. Analysis and breakdown the project in terms of specific activities and / or events.
2. Determine the independence and sequence of specific activities and prepare a network.
3. Assign estimates of time, cost or both to all the activities of the network.
4. Identify the longest or critical path through the network.
5. Monitor, evaluate and control the progress of the project by replanting, rescheduling and reassignment of resources.
6. The critical path of a project can change during the course of the project, due to uncertainties in completing the activities as per the original plan. For this purpose the network needs to be updated from time to time from the start of the project till the end of the project.

Que 5.8. Differentiate between PERT and CPM.

Answer

S. No.	PERT	CPM
1.	It originated from military situation.	It originated from industrial situation.
2.	The approach is event oriented.	The system is activity oriented.
3.	There is allowance for uncertainty.	There is no such allowance.
4.	There are three time estimations.	There is only one time estimation.
5.	There is emphasis on time.	There is emphasis on cost.
6.	It is a probabilistic model with uncertainty in activity duration.	It is deterministic model on well known single time based on past experience.
7.	There is no difference between critical and non-critical activities.	The critical activities are marked.
8.	Suitable for projects requiring high precision in time estimates. Examples : Defence projects.	Suitable for projects requiring reasonable precision in time estimates. Examples : Civil construction projects, industrial expansion schemes.

Que 5.9. **What are the time estimations used in PERT ?**

Answer

In PERT, we use three time estimations for each activity as given below :

A. Optimistic Time (t_o) :

1. It is the shortest possible time required for the completion of an activity under ideal conditions.
2. In calculating optimistic time, it is assumed that everything is favourable in completing the activity in shortest possible time.

B. Pessimistic Time (t_p) :

1. The maximum possible time, the activity will take under worst condition.
2. For pessimistic time, it is assumed that everything is unfavourable for completing the activity in time and thus activity will take maximum time to occur.

C. Most Likely Time (t_m) :

1. The most likely time is the time an activity will take if executed under normal conditions.
2. This time lies between optimistic and pessimistic time.
3. For calculating, most likely time, it is assumed that conditions are neither favourable nor unfavourable but normal.
4. On the basis of above three time estimations, expected time (t_e) or average time of completion of an activity can be calculated as

$$t_e = \frac{t_o + 4t_m + t_p}{6}$$

Que 5.10. **Explain the terms : Total float, free float, independent float, slack, critical event, critical activities.**

Answer

A. Total Float :

1. It may be defined as "the amount of time by which completion of an activity could be delayed beyond the earliest expected completion time without affecting overall project duration time."
2. Total Float, $TF_{ij} = LS_{ij} - ES_{ij} = (L_j - t_{ij}) - E_i$

$= L_j - E_i - t_{ij}$

Where, E_i = Earliest expected completion time of tail event.

= Earliest starting time for an activity (i, j).

and L_j = Latest allowable completion time of head event.

= Latest finish time of an activity (i, j).

3. Obviously, the total float of critical activities is always zero.

B. Free Float :

1. This is concerned with commencement of subsequent activity.
2. It may be defined as "the time by which the completion of an activity can be delayed beyond the earliest finish time without affecting the earliest start of a subsequent activity".
3. Using notations given earlier, the free float for activity (i, j) can be expressed as follows :

$$FF_{ij} = \text{Earliest event time for subsequent activity } j - \text{Earliest event time for activity } i - \text{Activity time for } (i,j)$$
$$= (E_j - E_i) - t_{ij}$$
$$= E_j - (E_i + t_{ij})$$
$$= \text{Min } \{ES_{ij}\} - EF_{ij}$$

C. Independent Float :

1. This is concerned with prior and subsequent activities.
2. It may be defined as "the amount of time by which the start of an activity can be delayed without affecting the earliest start time of any immediately successor activities, assuming that the preceding activity has finished at its latest finish time".
3. Independent float of an activity (i,j) is given by :

$$\text{Independent Float } (IF_{ij}) = (E_j - L_i) - t_{ij}$$

D. Slack of an Event :

1. The basic difference between slack and float times is that slack is used for events only whereas float is applied for an activity.
2. For any given event, the event slack is defined as the difference between the latest event and earliest event times. For a given activity (i,j) let us define :

$$\text{Head slack } (HS) = L_j - E_j \text{ and}$$
$$\text{Tail slack } (TS) = L_i - E_i$$

3. We can represent all the floats defined earlier, in terms of head and tail slack as shown below :

$$\text{Total float} = L_j - E_i - t_{ij}$$
$$\text{Free float} = \text{Total float} - \text{Head slack}$$
$$= L_j - E_i - t_{ij} - (L_j - E_j)$$

4. $$\text{Independent float} = \text{Free float} - \text{Tail slack}$$
$$= E_j - E_i - t_{ij} - (L_i - E_i)$$

E. Critical Event :

1. The slack of an event is the difference between the latest and earliest event times or slack $(i) = L_i - E_i$.

2. The events with zero slack time are known as critical events.

F. Critical Activities :

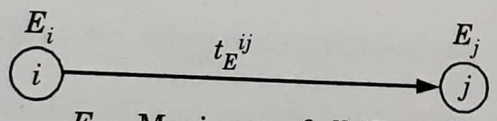
1. The difference between the least start time and earliest start time of an activity will indicate the amount of time by which the activity can be delayed without affecting the total project duration.
2. This difference is usually called the total float. Activities with zero total float are known as critical activities.

Que 5.11. Explain the following terms in PERT / CPM.

i. Earliest time, ii. Latest time,
iii. Total activity time, iv. Event slack, and
v. Critical path.

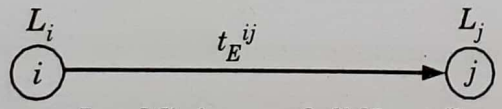
Answer

i. **Earliest Time :** It is the time at which an event is accepted to be completed at the earliest.



E_j = Maximum of all $[E_i + t_E^{ij}]$,

ii. **Latest Time :** It is the time at which a particular event must be completed at the latest.

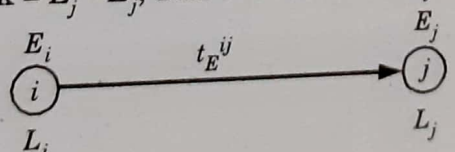


L_i = Minimum of all $[L_j - t_E^{ij}]$,

iii. **Total Activity Time :** It is defined as the time at which the project completed all its activities.

iv. **Event Slack :** It is define as the difference between latest event and earliest event times. Mathematically, for a given activity (i, j),

Head event slack = $L_j - E_j$, Tail event slack = $L_i - E_i$.



$S_i = L_i - E_i$

$S_j = L_j - E_j$

v. **Critical Path :** Refer Q. 5.7, Page 5–8Y, Unit-5.

Que 5.12. The following table lists the jobs of a network along with their time estimates :

Jobs	Duration in days		
	Optimistic	Most likely	Pessimistic
01 to 02	3	6	15
02 to 03	6	12	30
02 to 04	5	11	17
03 to 04	3	9	27
03 to 05	1	4	7
05 to 06	2	5	8
03 to 06	4	19	28
04 to 06	2	5	14

i. Draw the network and calculate the length and variance of critical path.

ii. What is the probability that jobs on critical path will be completed by the due date of 40 days ?

iii. What is your estimate of the probability that the entire project will be completed by the due date ?

Answer

1. The various time estimates are shown in the following table :

Activity	t_o	t_m	t_p	$t_e = \frac{t_o + t_p + 4t_m}{6}$	$\sigma^2 = \left(\frac{t_p - t_o}{6}\right)^2$
1 – 2	3	6	15	7	4
2 – 3	6	12	30	14	16
2 – 4	5	11	17	11	4
3 – 4	3	9	27	11	16
3 – 5	1	4	7	4	1
5 – 6	2	5	8	5	1
3 – 6	4	19	28	18	16
4 – 6	2	5	14	6	4

2. The network is shown in Fig. 5.12.1. The earliest and latest time of each have been computed and indicated on the network.

3. With the help of latest times, the longest path $1 \rightarrow 2 \rightarrow 3 \rightarrow 6$ can be traced.
Length of critical path = 7 + 14 + 18 = 39 days.

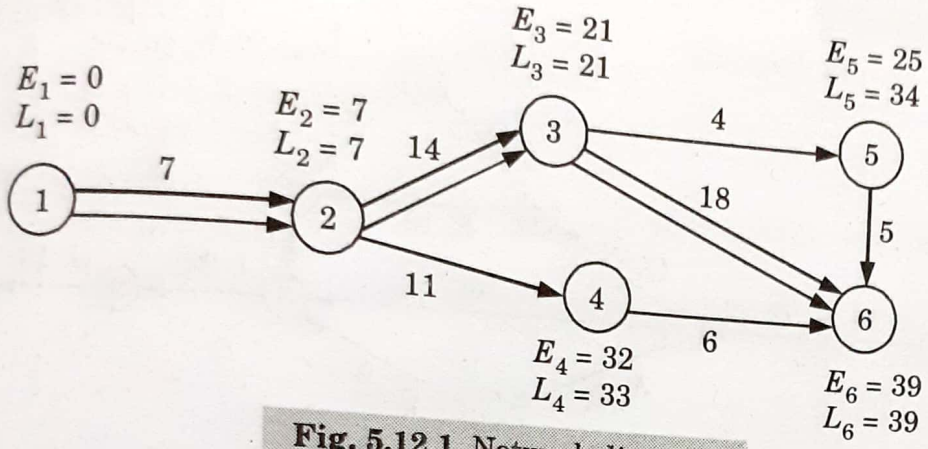


Fig. 5.12.1. Network diagram.

4. Standard deviation for critical path,

$$\sigma = \sqrt{4 + 16 + 16} = \sqrt{36} = 6 \text{ days}$$

5. The probability to complete the project before due date

$$Z = \frac{\text{Due date} - \text{Expected date}}{\sqrt{\sigma^2}}$$

$$= \frac{40 - 39}{\sqrt{36}} = 0.5662 = 56.62\ \%$$

6. Standard deviation of whole project

$$\sigma = \sqrt{4 + 16 + 4 + 16 + 1 + 1 + 16 + 4} = \sqrt{62} \text{ days}$$

7. The probability that the entire project will be completed by the due date

$$Z = \frac{40 - 39}{\sqrt{62}} = 0.127$$

$$= 0.5505 = 55.05\%$$

Que 5.13. **The following table shows the sequence of different activities performed during a project :**

Task	Immediate predecessors	Time (days)
A	–	14
B	*A*	22
C	*B*	10
D	*B*	16
E	*B*	12
F	*C*	10
G	*C*	6
H	*F, G*	8
I	*D, E, H*	24
J	*I*	16

i. Draw a network diagram of activities for the project.
ii. Indentify the critical path. What is its length ?

Answer

i. Network diagram :

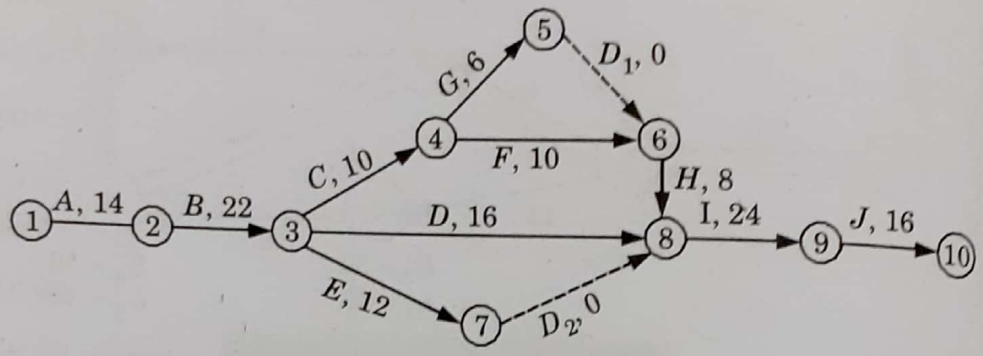


Fig. 5.13.1.

where, D_1 and D_2 are the dummy activities.

ii. Path (1 – 2 – 3 – 4 – 5 – 6 – 8 – 9 – 10) duration

= 14 + 22 + 10 + 6 + 0 + 8 + 24 + 16

= 100 days

Path (1 – 2 – 3 – 4 – 6 – 8 – 9 – 10) duration

= 14 + 22 + 10 + 10 + 8 + 24 + 16

= 104 days

Path (1 – 2 – 3 – 8 – 9 – 10) duration

= 14 + 22 + 16 + 24 + 16

= 92 days

Path (1 – 2 – 3 – 7 – 8 – 9 – 10) duration

= 14 + 22 + 12 + 0 + 24 + 16

= 88 days

Since, path (1 – 2 – 3 – 4 – 6 – 8 – 9 – 10) has maximum duration.

Hence, this is the critical path and duration = 104 days.

PART-4

Project Crashing.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.14. **What is the need of crashing the network ? What is the direct and indirect cost associated with network diagram ?**

Answer

A. Need of Crashing the Network : In order to find optimum duration which will result in minimum cost, we need to crash the network.

B. Direct Cost :

1. Direct cost decreases with increase of time and increases with crashing the activity.
2. It includes equipment, labour, material cost etc.

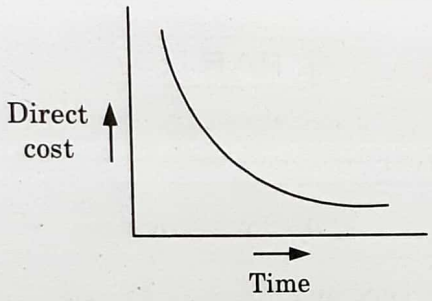


Fig. 5.14.1.

3. Slope of the direct cost is defined as

$$\text{Cost slope} = \frac{\Delta C}{\Delta T}$$

$$= \frac{C_c - C_n}{t_n - t_c}$$

Where,
t_n = Normal time of completion of an activity,
t_c = Minimum time of completion of an activity or crash time,
C_c = Crash cost (direct cost needed to complete the activity in t_c crash time), and
C_n = Cost corresponding to time t_n.

B. Indirect Cost :

1. It increases with increase of time and decrease with crashing.
2. Indirect cost includes overhead loss and other losses.
3. It also includes the expenditure of office, supervision cost, rental cost and other penalties etc.

Que 5.15. **Describe in detail about crashing of operation.**

Answer

In crashing following steps should be followed one by one :

Step 1 : Find critical path and normal project duration.

Step 2 : Find cost slope of each activity.

Step 3 : Select the activity with minimum cost slope and crash it first. While crashing, it should be remembered that it should not be crash beyond limit such that other paths become critical.

Step 4 : Select next higher cost slope with critical activity. While doing so, there may be one or more than one critical path. Then, one activity from each path should be crashed simultaneously by same amount of duration.

Step 5 : Repeat the above steps unless total minimum cost and optimum duration is obtained.

PART-5

Resource Levelling.

Questions-Answers

Long Answer Type and Medium Answer Type Questions

Que 5.16. Write short note on resource leveling.

Answer

A. Resource Levelling :

1. There are various activities in a project demanding varying levels of resources. The demand on certain specified resources should not go beyond the prescribed level. This operation of resources allocation is called resource levelling.
2. In the process of resource levelling, whenever the availability of resource becomes less than its maximum requirement, the only alternative it to delay the activity having larger float.
3. In case, two or more activities require the same amount of resources, the activity with minimum duration is chosen for resource allocation. Resource levelling is done if the restriction is on the availability of resources.

B. Steps Involved in Resource Levelling :

1. Lower the peak requirement of the resources by staggering the resource input on non-critical activities. If necessary, sub-critical and critical activities can also be tackled to bring peak demands below the specified levels. Thus, completion of work may be delayed due to resource constraints.

2. Either i
concurr
resourc
3. Rearran
positive
which p

Que 5.17.
levelling.

Answer

A. Advan
1. When r
manage
2. It may
policy f
3. It resu
departr
4. It often
B. Disadv
1. Tends t
2. Increas

2. Either increase the duration of critical activities or place some of the concurrent activities in series to reduce the peak demands of the scarce resources. This will increase the duration of the project.
3. Rearrange the activities in descending order of the magnitude of the positive float, as resources can be conveniently diverted from the activities which possess large amount of float.

Que 5.17. Write the advantages and disadvantages of resource levelling.

Answer

A. Advantages of Resource Levelling :

1. When resources are used on a more constant basis, they require less management.
2. It may enable project managers to use a just-in-time inventory type of policy for using subcontractors or other expensive resources.
3. It results in fewer problems for project personnel and accounting department.
4. It often improves morale.

B. Disadvantages of Resource Levelling :

1. Tends to cause a buildup of resources towards the end of the project.
2. Increasing the number of critical activities.

1 UNIT

Introduction (2 Marks Questions)

1.1. Define industrial management.

Ans. The branch of engineering that deals with the creation and management of systems that integrate people, materials and energy in productive ways is known as industrial management.

1.2. Write the nature of industrial management.

Ans.

1. Its contribution to objectives.
2. Its primacy among the manager's tasks.
3. The efficiency of plans.
4. Dynamic in nature.
5. Continuous improvement process.

1.3. Give the scope of industrial management.

Ans. Scope of industrial management is as follows :

1. Expertise help,
2. Advice and consultancy,
3. System analysis,
4. Training and motivation, and
5. Decision making.

1.4. What are the applications of industrial management ?

AKTU 2015-16, 2016-17, 2017-18; Marks 02

Ans. Applications of industrial management are as follows :

1. Pre-production planning,
2. Production planning and control,
3. To improve the process and service,
4. Total quality management,
5. Inventory management and store keeping, and
6. Decision making.

1.5. Define productivity and formula to measure it.

AKTU 2017-18, Marks 02

OR

Explain productivity index. **AKTU 2015-16, Marks 02**

Ans. Productivity is a ratio of actual output (production) to what is required to produce it (inputs).

$$\text{Productivity} = \frac{\text{Actual Output}}{\text{Actual Input}}$$

1.6. Write any five important uses of productivity measurement ? **AKTU 2017-18, Marks 02**

Ans.
1. Productivity increases output.
2. Higher productivity helps to reduce cost per piece.
3. Low price increases demand of the product which in turn increases profit of the organisation.
4. Higher profit enables organisation to offer higher dividend for shareholders.
5. It increases export and increases foreign exchange reserves of a country.

1.7. What are the factors which affect productivity ?

Ans. Factors affecting productivity are as follow :
1. Human resources,
2. Technology and capital investment,
3. Government regulation,
4. Product and system design, and
5. Machinery and equipment.

1.8. What are different types of productivity measurement ?

Ans. Types of productivity measurement are as follow :
1. Land productivity,
2. Material productivity,
3. Labour productivity,
4. Machine productivity, and
5. Capital productivity.

1.9. What is role of work study in improving productivity ? **AKTU 2015-16, Marks 02**

Ans. Improving productivity in work study ensures the best possible use of human, machine and material resources and to achieve best quality product/service at minimum possible cost.

1.10. What are the types of production system ?

Ans. Types of production system are as follow :
1. Mass production system,

2. Process production system,
3. Job production or project type production system, and
4. Batch production system.

1.11. Define intermittent and continuous production system.

Ans. **Intermittent production system :** In this system, the goods are manufactured specially to fulfill orders made by customers rather than for stock.

Continuous production system : In this system, the items are produced for the stocks and not for specific orders.

1.12. What do you mean by industrial ownership ?

Ans. It is defined as an organisation engaged in industrial activities. This term is used interchangeably with industrial enterprise, business firm, business concern etc.

1.13. Give the categories of industrial ownership.

Ans. The industrial ownership is classified into three categories :
1. Private sector
2. Public sector
3. Joint sector

1.14. Define partnership.

Ans. **Partnership :** The Indian Partnership Act 1932 defines a partnership as "the relation between two or more persons who have agreed to share the profits from a business carried on by either all of them or any of them on behalf of/acting for all".

1.15. What are different types of partner ?

Ans. Different types of partners are as following :
1. Active partner,
2. Dormant partner,
3. Secret partner, and
4. Nominal partner.

1.16. Define Dayabhaga and Mitakashara system in joint Hindu family business. **AKTU 2016-17, Marks 02**

Ans.

i. **Dayabhaga System :** Here both male and female members will be co-parceners in the Hindu undivided family.

ii. **Mitakashara System :** Here only the male family members are admitted into the Hindu undivided family and the female members have no share.

1.17. Differentiate between mass production and job production system.

Ans.

AKTU 2016-17, Marks 02

S. No.	Mass Production System	Job Production System
1.	In mass production system, items are produced in large amount.	In job production system, goods are produced according to customer's demand.
2.	**For example :** Newspapers and magazines etc.	**For example :** Ship building, dam construction etc.

2 UNIT

Management Function (2 Marks Questions)

2.1. What is management ?

Ans. Management is the process of planning, organizing, leading and controlling the efforts of organization members and of using all other organization resources to achieve stated organizational goal.

2.2. What are the functions of management ?

Ans. The functions of management are :

1. Planning
2. Organizing
3. Staffing
4. Directing (Leading)
5. Coordinating
6. Controlling
7. Motivating
8. Communicating

2.3. What are the principles of scientific management ?

Ans. Four principles of scientific management are :

1. Science, not rule of thumb.
2. Scientific selection, training and development of workers.
3. Cooperation, not individualism.
4. Harmony, not discord.

2.4. What are the goals of scientific management ?

Ans. Goal of scientific management :

i. Increased production.
ii. Quality control.
iii. Cost reduction.
iv. Elimination of wastes.
v. Right men for right work.
vi. Incentive wages.

2.5. What is social responsibility ?

Ans.

1. Social responsibility denotes differentiating right from wrong and doing the right thing.
2. Social responsibility is management's obligation to make choices and take actions that contributes to the well-being and interests of society as well as the organization.

2.6. What are the social responsibilities of an enterprise towards government ?

Ans. Social responsibilities of an enterprise towards the government :

1. To abide by rules, regulations and laws.
2. To pay taxes and duties on time.
3. To help in solving social problem.

2.7. Define human resource.

Ans. Human resources are the people who work for an organization in jobs that produce the products or services of the business or organization.

2.8. What are the functions of HRM ?

Ans. The main functions of human resource management are classified into two categories :

a. Managerial Functions :

1. Planning
2. Organization
3. Directing
4. Controlling

b. Operative Functions :

1. Procurement of personnel
2. Development of personnel
3. Compensation to personnel
4. Maintaining good industrial relation
5. Record keeping
6. Personnel planning and evaluation

3 UNIT

Work Study and Inventory Control (2 Marks Questions)

3.1. Define work study.

Ans. Work study is a technique used to examine the activities done by human being and investigate those factors that affect the accuracy and efficiency of the workers. Work study helps to complete a particular work or job in the best possible way.

3.2. Define method study. What are its objective ?

AKTU 2015-16, Marks 02

AKTU 2017-18, Marks 02

Ans. Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing costs.

Objective of Method Study :

1. It improves the proper utilisation of manpower, machine and materials.
2. It also improves the factory layout, work place, etc.
3. It also improves the process and procedure.

3.3. What are the objectives of motion study ?

Ans. **Objectives of Motion Study :**

1. Removal of unwanted motions.
2. Increase the efficiency of all activities.
3. Improve the proper motion of activities.
4. Enhancing the material handling process.

3.4. What is process chart ? Give its various types.

Ans. **Process chart :** A process chart is a representation of events and information connected to the process. Process chart is a diagrammatic representation of all the activities involved in the process. Charts are represented by symbols.

Types of process chart :

i. Flow process chart (for workers, materials and equipments).
ii. Outline process chart.
iii. Operator process chart or Two-handed process chart.

3.5. List the symbols used in process chart.

OR

Enlist any two symbols of process chart.

AKTU 2016-17, Marks 02

AKTU 2017-18, Marks 02

Ans. The symbols used in process chart are :

i. Operation (O)
ii. Inspection (□)
iii. Transportation (⇒)
iv. Delay (D)
v. Storage (▽)

3.6. What is flow diagram ? **AKTU 2015-16, Marks 02**

Ans. Flow diagram is a drawing or a diagram substantially to scale which shows the relative position of production machinery, jigs, fixtures etc., and marks the paths followed by men (workers) and material.

3.7. What do you mean by standard time ?

AKTU 2015-16, Marks 02

Ans.

1. Standard time is the time allowed to an operator to carry out the specified task under specified conditions and defined level of performance.
2. The various allowances are added to the normal time as applicable to get the standard time "components standard time".

Standard time = Normal time + Allowances

3.8. Write the components of standards time.

Ans. Components of Standard Time :

OT - Observed Time
PRF - Performance Rating Factor
NT - Normal Time
PA - Process Allowances
RPA - Rest and Personal Allowances
SA - Special Allowances
PoA - Policy Allowances

3.9. Define production planning.

Ans.

1. Production Planning is concerned with the determination, acquisition and arrangement of all facilities necessary for future operations.
2. Production planning means to fix the production goals and to estimate the resources which are required to achieve these goals.

3.10. List out the steps in production planning.

Ans. Steps in production planning and control are as follows :

i. Planning
ii. Routing
iii. Scheduling
iv. Dispatching
v. Follow-Up (or Checking the Progress)
vi. Inspection

3.11. What are the objectives of production planning ?

Ans. **Objectives of Production Planning :**

1. Effective utilization of resources.
2. Steady flow of production.
3. Estimate the resources.
4. Ensures optimum inventory.
5. Coordinates activities of departments.

3.12. Define inventory control.

Ans. Inventory control is the technique of maintaining the size of the inventory at some desired level keeping in view the best economic interests of an organization. It is the process of deciding what and how much of various items are to be kept in stock.

3.13. Differentiate between inventory and stocks.

AKTU 2017-18, Marks 02

Ans.

S. No.	Inventory	Stocks
1.	Inventory includes finished products, raw materials used to make the products, the machinery used to produce the products and the building in which the products are made.	Stock is the finished product that is sold by the business.
2.	Inventory includes sale products, the goods and materials used to produce them.	Stock deals with products that are sold as part of the business's daily operation.
3.	Inventory takes in account all of the assets a business uses to produce the goods it sells and determines the sale price for the stock.	The stock determines the amount of revenue a business generates.

3.14. What are the types of inventory ?

Ans. **Types of Inventory :**
1. Raw material inventory
2. Work in progress (WIP)/Semi-finished inventory
3. Finished goods inventory

3.15. What are the costs associated with inventory ?

Ans. There are three types of costs associated with inventory :
i. Holding/Carrying Cost
ii. Ordering Costs
iii. Stock-out Costs

3.16. What is meant by economic order quantity ?

AKTU 2015-16, Marks 02

OR

What do you mean by EOQ ? Write the formula for EOQ.

Ans. Economic Order Quantity (EOQ) is that size of order which minimizes total annual costs of carrying inventory and cost of ordering.
The formula for economic order quantity :

$$EOQ = \sqrt{\frac{2DS}{H}}$$

EOQ is the economic order quantity (units).
D is demand per year,
S cost per order, and
H cost of holding per unit of inventory.

3.17. What do you understand by 'JIT' and 'Kanban system' ?

AKTU 2016-17, Marks 02

OR

Define JIT with example.

AKTU 2017-18, Marks 02

Ans. **JIT :** Just-In-Time (JIT) is a strategy to increase efficiency and decrease waste by receiving goods only as they are needed in the production process, thus reducing inventory costs.
Example : General Motors operates using a JIT inventory as parts needed to manufacture the cars do not arrive before or after they are needed; rather, they arrive just as they are needed.
Kanban : In practice managers employ combinations of several elements which include smoothing of production, providing for process flexibility and versatility, standardization of jobs, and utilization of and ordering and delivery system is called Kanban.

4 UNIT

Quality Control (2 Marks Questions)

4.1. Define quality.

Ans. Quality is the degree of perfectness of the object with respect to the standard.

4.2. Explain the Concept & Different parameters of quality.

AKTU 2017-18, Marks 02

Ans. Quality reflects both objective and subjective aspects of product/service. The parameters of a quality are difficult to determine and it is different for different processes like for manufacturing it can be quality of design, quality conformance, reliability, safety, proper storage. For IT, the information can be termed as of a good quality if it meets the norms of impartiality, validity, reliability, consistency and age.

4.3. Discuss the different types of quality costs.

AKTU 2017-18, Marks 02

Ans. Quality costs are categorized into four main types. These are:

1. Prevention costs
2. Appraisal costs
3. Internal failure costs
4. External failure costs.

4.4. Define Quality Control.

Ans. Quality control is the set of measures and procedures to follow in order to ensure that the quality of a product is maintained and improved against a set of benchmarks and any errors encountered are either eliminated or reduced.

4.5. Give the factors which affect the quality of a product.

Ans. Following are the factors which affect the quality of a product :

1. Demand of customers.
2. Degree of mechanization.
3. Capability of investors to invest capital.
4. Quality of man power.
5. Production method and technology.

4.6. Write the steps to improve quality.

Ans. Steps to improve quality are :

1. Improved raw material.
2. Better technology.
3. Scientific selection of workers.
4. Good working conditions.
5. Harmonious relations.
6. Quality and cost consciousness.

4.7. Explain the term process control.

AKTU 2015-16, Marks 02

Ans. Process control is a technique used for understanding and monitoring the process by collecting data on quality characteristics periodically from the process and analyze them and take suitable actions whenever there is a difference between actual quality and the specifications or standard.

4.8. Write the limitations of process control.

Ans. Limitations of process control :

1. Difficulty in setting qualitative standards.
2. No control over external factors.
3. Resistance from employees.
4. Costly affair.

4.9. Define statistical quality control.

AKTU 2016-17, Marks 02

OR

What is meant by SQC, describe its importance ?

AKTU 2017-18, Marks 02

Ans.

Statistical Quality Control (SQC) refers to the use of statistical methods in monitoring and maintaining the quality of products and services.

Importance of SQC :

1. Detects Quality Deviation
2. Acceptance by customers
3. Earns goodwill
4. Timely delivery of goods
5. Improves productivity
6. Motivates employees

4.10. What are control charts ?

OR

What do mean by central line, upper control limit and lower control limit ?

AKTU 2015-16, Marks 02

Ans.

1. Control chart is a graph used to study how a process changes over time.
2. Data are plotted in time order.
3. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit.

4.11. What is mean chart ?

Ans. Mean chart or $\bar{X}$-chart is a variable control chart that is used to monitor the arithmetic means of successive samples of constant size. This type of control chart is used for characteristics that can be measured on a continuous scale, such as weight, temperature, thickness etc.

4.12. Define sampling.

Ans. Sampling is the process of selecting units from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen.

4.13. What is sequential acceptance sampling ?

AKTU 2015-16, Marks 02

Ans.

1. The sequential-sampling plan is refinement of the double sampling plan, in which we randomly selects items from the lot and inspects them one by one.
2. Each time an item is inspected, a decision is made to (1) reject the lot, (2) accept the lot, or (3) continue sampling, based on the cumulative results so far.

4.14. What is TQM (Total Quality Management) ?

AKTU 2016-17, Marks 02

Ans. Total Quality Management, abbreviated as TQM is a people-oriented management system, wherein all the members of the organization, makes continuous efforts so as to maintain high work standards, in all the operations of the company.

4.15. Write the five principles of TQM.

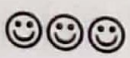
Ans. Five principles of TQM :

1. Long-term management commitment to quality
2. Customer-focused
3. Preventing, and not detecting defects
4. Universal quality responsibility
5. Measurement of quality.

4.16. What are the issues involved in TQM ?

Ans. Issues involved in TQM are :

1. Competitive markets.
2. Bad attitudes/abdication of responsibility/management infallibility.
3. Lack of leadership for quality.
4. Deficiency of cultural dynamism.



5 UNIT

Project Management (2 Marks Questions)

5.1. Define project management.

Ans. Project management is the practice of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time.

5.2. Write the name of stages of project life cycle.

Ans. Project life cycle consists of following stages :

1. Initiation,
2. Planning,
3. Execution, and
4. Closure.

5.3. What is network analysis ?

Ans. Network analysis is the general name given to certain specific technique which can be used for the planning, management and control of projects.

5.4. Define CPM.

Ans. The critical path method (CPM) is a step-by-step project management technique for process planning that defines critical and non-critical tasks with the goal of preventing time frame problems and process bottlenecks.

5.5. Define PERT.

Ans. PERT is the basic network technique which includes planning, monitoring and control of projects. It is applied in planning and control of complex set of tasks, function and relationships.

5.6. Discuss critical path.

Ans. In project management, a critical path is the sequence of project network activities which add up to the longest overall duration, regardless if that longest duration has float or not. This determines the shortest time possible to complete the project.

5.7. Discuss project crashing.

Ans. Project crashing is a method for shortening the project duration by reducing the time of one (or more) of the critical project activities to less than its normal activity time.

5.8. Define resource levelling.

Ans. A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply is known as resource levelling.

B. Tech.
(SEM. VI) EVEN SEMESTER THEORY EXAMINATION, 2013-14
INDUSTRIAL MANAGEMENT

Time : 2 Hours **Max Marks : 50**

Note : Attempt **all** questions.

1. Answer any **two** parts : **(10 × 2 = 20)**

a. What is industrial management ? Describe about the application and scope of industrial management in the field of engineering.

Ans. **Industrial Management :** Refer Q. 1.1, Page 1–2Y, Unit-1.
Application of Industrial Management : Refer Q. 1.4, Page 1–4Y, Unit 1.
Scope of Industrial Management : Refer Q. 1.3, Page 1–3Y, Unit-1.

b. What are the different patterns of industrial ownership ? Detail any one.

Ans. **Different patterns of Industrial Ownership :** Refer Q. 1.18, Page 1–14Y, Unit-1.
Sole Proprietorship : Refer Q. 1.19, Page 1–14Y, Unit-1.

c. What do you think about management ? Elaborate fourteen 'principles of management' by Sir Henry Fayol ?

Ans. Refer Q. 2.5, Page 2–7Y, Unit-2.

2. Attempt any **two** parts : **(10 × 2 = 20)**

a. What is production planning ?

Ans. Refer Q. 3.13, Page 3–11Y, Unit-3.

b. What is the role of 'time study' in production ?

Ans. Refer Q. 3.6, Page 3–5Y, Unit-3.

c. Brief any one method of inventory management.

Ans. **ABC Analysis :** Refer Q. 3.23, Page 3–22Y, Unit-3.

3. Attempt any **two** parts : **(10 × 2 = 20)**

a. What are the different costs associated with inventories ?

Ans. Refer Q. 3.18, Page 3–17Y, Unit-3.

b. What do you understand by supply chain management ?

Ans. Supply chain management (SCM) is the management of the flow of goods and services. It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption.

Importance of SCM :

1. **Cost Control :** Cost control is a series of steps that a business uses to maintain proper control over its costs. Implementing this level of control can have a profound positive impact on profits over the long term.
2. **Customer Services :** Customer service is the provision of service to customers before, during and after a purchase. The perception of success of such interactions is dependent on employees "who can adjust themselves to the personality of the guest".
3. **Risk Management :** Risk management is the identification, assessment, and prioritization of risks (defined in ISO 31000 as the effect of uncertainty on objectives) followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events.
4. **Better Production Planning :** Production planning is the planning of production and manufacturing processes in a company or industry. It utilizes the resource allocation of activities of employees, materials and production capacity, in order to serve different customers.
5. **Planning for Future Strategies :** A systematic process of envisioning a desired future, and translating this vision into broadly defined goals or objectives and a sequence of steps to achieve them.

c. Give a brief description of statistical quality control.

Ans. Refer Q. 4.2, Page 4–3Y, Unit-4.

4. Attempt any **two** parts : **(10 × 2 = 2)**

a. What is total quality management ? Why is it important for engineering organizations ?

Ans. Refer Q. 4.15, Page 4–15Y, Unit-4.

b. What are the available management techniques to control environment pollution ?

Ans. Various techniques to control environment pollution are :

1. **Control of Noise Pollution :**

i. Manufacturing of equipments which would keep a low noise level at the site of origin itself.

ii. Transmission of noise can be retarded by covering the walls with sound absorbing materials.

iii. Special sound absorbing wear for person working with noise producing machines are recommended.

iv. Cultivation of p
noise is very use
v. Silence zone r
indiscriminate u
laws.
vi. Adequate restri
and vehicles pla
2. Soil Pollution
i. Effluents should
the soil.
ii. Solid wastes sh
appropriate met
iii. From the wastes
iv. Biodegradable or
v. Cattle dung shou
also used in the
vi. Microbial degra
the scientific ap
3. Control of Air
1. Source Correc
that raw materi
is modified to m
2. Collection of
encountered. Ve
only because the
3. Cooling : Exha
treated. So first
following metho
(*a*) Dilution (*b*)
4. Control of Wat
the water pollut
1. Input control to
place.
2. Output control a
have produced.
3. Developing of pr
reduce incoming
4. Non-point sourc
afforestation in
5. A required level
waters should b
bodies or on land
6. Treatment plant
manner that effl
them for irrigati

iv. Cultivation of plants or vegetations which are known to reduce noise is very useful.

v. Silence zone must be created near school, hospitals and indiscriminate use of loudspeakers at public places may be done by laws.

vi. Adequate restrictions must be put on unnecessary use of horns and vehicles playing without silencer.

2. Soil Pollution Control :

i. Effluents should be properly treated before discharging them on the soil.

ii. Solid wastes should be properly collected and disposed off by appropriate method.

iii. From the wastes, recovery of useful products should be done.

iv. Biodegradable organic waste should be used for generation of biogas.

v. Cattle dung should be used for methane generation. Night-soil can also used in the biogas plant to produce inflammable methane gas.

vi. Microbial degradation of biodegradable substances is also one of the scientific approaches for reducing soil pollution.

3. Control of Air Pollution :

1. **Source Corrections :** It means when we change the process, or that raw material is converted to some other form, the equipment is modified to meet emission standards.
2. **Collection of Pollutant :** It is the most serious problem encountered. Vehicles are the source of most serious pollutants only because the emission cannot be collected readily.
3. **Cooling :** Exhaust gases collected are sometimes too hot to be treated. So first they have to be cooled down. This can be done by following methods :
   (*a*) Dilution (*b*) Quenching (*c*) Heat exchanger coils.
4. **Control of Water Pollution :** The following measures can control the water pollution :

1. Input control to prevent the pollutants to be generated in the first place.
2. Output control allows to control the pollutants and their effect they have produced.
3. Developing of proper sewage system for the industrial effluent can reduce incoming point source of pollution.
4. Non-point source of pollution can be minimized by extensive afforestation in open areas.
5. A required level of treatment of domestic and industrial waste waters should be carried out before disposing them into water bodies or on land.
6. Treatment plant for domestic sewage should be designed in such a manner that effluents are being adopted in river instead of using them for irrigation purpose.

7. Treatment effluents from industries should be discharged into water sources only after meeting the disposal standards. It will be better to treat the effluent from each component of an industry separately.
8. There should be no intermixing of solid waste or effluent in water source used for drinking or agriculture purpose should be done.
9. Public awareness regarding water pollution should be treated.
10. Strict enforcement of pollution control laws.

5. Control of Thermal Pollution : The following methods can be employed for control of thermal pollution :

i. Cooling ponds
ii. Spray ponds
iii. Cooling towers

c. Detail various acts for air and water pollution.

Ans. **Air (Prevention and Control of Pollution) Act, 1981 :** This is an act to provide for the prevention, control and reduction of air pollution in the country so as to preserve the quality of air.

The salient features of the Air (Prevention and Control of Pollution) Act 1981 are as follows :

1. Act is applicable to the whole India.
2. Under section 19 of the Act, the State Government in consultation with the State Pollution Control Board (SPCB) has the power to declare Air Pollution Control Area, in which provisions of the Act shall be applicable.
3. As per provisions in section 21(1) and (2), no person can establish or operate any industrial plant without the previous consent of the State Pollution Control Board.
4. Every application for consent shall be made in Form I and shall be accompanied by a prescribed fee. Within a period of four months after the receipt of application, the Board shall complete the formalities to either refuse or grant consent. During the course of processing consent for the application, the Board may seek any information about the industry after giving notice in Form II.
5. Under section 22, 22(A) operating any industrial plant so as to cause emission of any air pollutant in excess of standard laid down by the State Board is liable for legal action by the Board.
6. Under section 2(a), the term air pollutant is defined as any solid, liquid or gaseous substance present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

Water (Prevention and Control of Pollution) Act, 1974 : It provides for maintaining and restoring the wholesomeness of water by preventing and controlling its pollution.

The salient features and provisions of the Act are summed up as follows :

1. It provides for maintenance and restoration of quality of all types of surface and ground water.

2. It provides for the establishment of Central and State Boards for pollution control.
3. It confers them with powers and functions to control pollution.
4. The Central and State Pollution Control Boards are widely represented and are given comprehensive powers to advise, coordinate and provide technical assistance for prevention and control of pollution of water.
5. The Act has provisions for funds, budgets, accounts and audit of the Central and State Pollution Control Boards.
6. The Act makes provisions for various penalties for the defaulters and procedure for the same.

5. Write short notes on any **four :** **(5 × 4 = 20)**

a. Productivity index
b. Motion Study
c. Inventory Costs
d. Total Quality Management
e. Solid Waste.

Ans. **Productivity Index :** Refer Q. 1.12, Page 1–9Y, Unit-1.
Motion Study : Refer Q. 3.5, Page 3–4Y, Unit-3.
Inventory Costs : Refer Q. 3.18, Page 3–17Y, Unit-3.
Total Quality Management : Refer Q. 4.15, Page 4–15Y, Unit-4.
Solid Waste : The waste materials which have been rejected for further use and which can neither readily escape into the atmosphere nor can be transported by water into streams are called solid waste.
Following are the various health and environmental hazards of solid waste :

1. Flies and mosquitoes breed on choked drains and gully pits through solid wastes. These flies and mosquitoes then contaminate food and water. In turn, diseases like diarrhea, amoebic dysentery, bacillary dysentery, malaria, dengue, etc. result.
2. Stray animals and scavengers invade the roadside garbage dumps. It results in harming the aesthetic beauty of the surroundings.
3. Bad odours pollute the air as a result of decomposition of organic solid wastes.
4. Percolation of decomposed garbage causes pollution of underground water and land. The crops and water supply get contaminated and result in occurrence of cholera, hepatitis, jaundice, gastro-intestinal diseases.
5. Rats living in solid waste dumping sites rapidly multiply in numbers and may cause plague and other diseases.
6. E-waste is either burnt or buried, so it can have harmful effects on the environment. This is because E-waste contains many hazardous materials like lead, mercury, cadmium, flame retardants, etc.

B.Tech.
(SEM. VI) EVEN SEMESTER THEORY EXAMINATION, 2014-15
INDUSTRIAL MANAGEMENT

Time : 3 Hours **Total Marks : 100**

Note : 1. Attempt **all** questions.
2. Marks allotted to each question are indicated on right hand side.

1. Attempt any **four** parts of the following : **(4 × 5 = 20)**

a. Write a detailed note on development of industrial management.

Ans. Refer Q. 1.6, Page 1–4Y, Unit-1.

b. Define productivity. State its importance giving suitable examples.

Ans. Refer Q. 1.9, Page 1–6Y, Unit-1.

c. What are the benefits of increasing productivity to the workers and management ?

Ans. Refer Q. 1.11, Page 1–8Y, Unit-1.

d. Differentiate between job production, batch production and mass production.

Ans. Refer Q. 1.16, Page 1–12Y, Unit-1.

e. What is meant by joint stock company ? Compare it with partnership organization.

Ans. Refer Q. 1.25, Page 1–21Y, Unit-1.

f. What is public sector organisation ? What are its aims and objectives ?

Ans. Refer Q. 1.22, Page 1–18Y, Unit-1.

2. Attempt any **two** parts of the following : **(2 × 10 = 20)**

a. Define work study. State its objectives. Differentiate between method study and work measurement.

Ans. Refer Q. 3.3, Page 3–3Y, Unit-3.

b. What is the importance of outline process chart in method study ? Compare outline process chart and flow process chart.

Ans.

1. An outline process chart is a process chart which gives an overall view of a process by recording only the main operations and sequences in proper sequence.
2. So, it's obvious that such a chart requires only symbols for 'Operations' and 'inspection'.

3. A brief note of the nature of each inspection and operations is written alongside the symbol. Allowed time where ever, known, can also be added.
4. An outline process charts has the following uses in method study :
a. For specifying the basic manufacturing system.
b. For determining the sequence of assembly.
c. To introduce manufacturing system to new technical personnel.

Comparison : In addition to symbols used in outline process charts, transport, delay and storage symbols are also used in flow process charts. Operations defined per sheet in flow process charts are usually less than the operations defined per sheet in outline process chart because of the greater details.

c. Define the term production planning. State its objectives. What are the various steps in production planning ?

Ans. Refer Q. 3.13, Page 3–11Y, Unit-3.

3. Attempt any **two** parts of the following : **(2 × 10 = 20)**

a. Define inventory. What is direct and indirect inventory ? What are the different costs associated with inventory ?

Ans. Refer Q. 3.16, Page 3–15Y, Unit-3.

b. What do you understand by supply chain management ? What are the different components of supply chain ?

Ans. **Supply Chain Management :** Refer Q. 3(b), Page SQ–2Y, Solved Paper 2013-14.

Components of Supply Chain :

1. **Plan :**
a. The first stage in supply chain management is known as plan.
b. A plan or strategy must be developed to address how a given good or service will meet the needs of the customers.
c. A significant portion of the strategy should focus on planning a profitable supply chain.
2. **Develop (Source) :**
a. Develop is the next stage in supply chain management.
b. It involves building a strong relationship with suppliers of the raw materials needed in making the product that company delivers.
c. This phase involves not only identifying reliable suppliers but also planning methods for shipping, delivery, and payment.
3. **Make :**
a. At the third stage, the product is manufactured, tested, packaged, and scheduled for delivery. This is the manufacturing step.
b. Supply chain managers schedule the activities necessary for production, testing, packaging and preparation for delivery.
c. This is the most metric-intensive portion of the supply chain one where companies are able to measure quality levels, production output and worker productivity.

4. **Deliver :**

a. This is the fourth stage of supply chain management where customer orders are received and delivery of the goods is planned.

b. This is the part that many SCM insiders refer to as logistics, where companies coordinate the receipt of orders from customers, develop a network of warehouses, pick carriers to get products to customers and set up an invoicing system to receive payments.

5. **Return :**

a. The final stage of supply chain management is called return in which customers may return defective products.

b. The company will also address customer questions in this stage.

c. Supply chain planners have to create a responsive and flexible network for receiving defective and excess products back from their customers and supporting customers who have problems with delivered products.

c. What do you understand by economic order quantity ? How do you calculate EOQ ? Explain.

Ans. Refer Q. 3.19, Page 3–18Y, Unit-3.

4. Attempt any **two** parts of the following : **(2 × 10 = 20)**

a. Define quality. What is the difference between quality and total quality management ?

Ans. Refer Q. 4.17, Page 4–17Y, Unit-4.

b. What do you understand by process control ? Define control chart and give the objectives of $\bar{X}$ and R charts.

Ans. Refer Q. 4.8, Page 4–10Y, Unit-4.

c. What do you understand by acceptance sampling ? Explain the methods of double sampling and sequential acceptance sampling.

Ans. **Acceptance Sampling :** Refer Q. 4.10, Page 4–11Y, Unit-4.
Double Sampling : Refer Q. 4.12, Page 4–12Y, Unit-4.
Sequential Sampling : Refer Q. 4.13, Page 4–13Y, Unit-4.

5. Attempt any **two** parts of the following : **(2 × 10 = 20)**

a. What do you understand by air pollution ? What are its various sources ? How are the pollutants classified ?

Ans.

A. **Air Pollution :** Air pollution is the presence of substances in the air (which generally originate from human activities) in sufficient concentrations and sufficient time, to interface with the comfort, health, safety or full use and enjoyment of property.

B. **Types of Air Pollutants :** Air pollutants can be of two types :

1. **Primary Pollutants :** These are emitted directly into the atmosphere. Common sources of primary pollutants include power

station and industrial plants (sulphur dioxide), and road transport (carbon monoxide, particulate matter and nitrogen oxides).

2. **Secondary Pollutants :** These types of pollutants are formed in the air as a result of chemical reactions occurring between primary pollutants.

C. **Causes of Air Pollution :** The principal causes of air pollution are categorized into the following two types :

1. **Natural Causes :**

i. Natural disasters such as cyclones, volcanic eruptions, and earthquakes cause suspension of dust particles and ash in air cause air pollution.

ii. Air pollution may also be caused by other natural factors such as forest fires, pollen grains, microbes, etc.

iii. Various gases are also released into the atmosphere as a result of natural processes; for example, methane gas is released in natural gas fields due to decay of organic matter, radon gas is released due to radioactive decay within the Earth's crust, and smoke and carbon monoxide are emitted during forest fires.

2. **Man-made Causes :** Human beings are the major contributors to air pollution. Some of the man-made causes of air pollution are :

i. **Industrial Wastes :**

a. Different industries produce air pollution in different manners depending on the processes involved.

b. Petroleum refineries emit large amounts of hydrocarbons and particulate matter, and industries such as iron and steel mills, paper mills, chemical plants, and cement plants release vast amounts of different types of particulates into the atmosphere.

ii. **Automobiles :**

a. Owing to the rapid increase in population, the number of automobiles on the roads has also increased.

b. These automobiles make transportation easy and convenient, but also emit dangerous pollutants such as carbon monoxide, carbon dioxide, sulphur dioxide, nitrogen oxides, hydrocarbons, ozone, particulates, lead, and chlorofluorocarbons.

iii. **Thermal Power Stations :**

a. To meet the increasing demand for electricity by human beings for a variety of purposes, a large number of thermal power stations have been set up.

b. Most thermal stations use coal as the main fuel and coal ash is generated as a waste product.

c. This coal ash is handled in wet form and is disposed in ash ponds.

iv. **Nuclear Explosions :**

a. A nuclear explosion causes severe air pollution across a large area.

b. It releases huge amounts of pollutants including many hazardous chemicals and dust particles into the atmosphere.

c. Huge amounts of radioactive material with long lifetimes, which cause great damage on the health and well-being of the human beings and animals.

v. **Agricultural Activities :**

a. The excessive use of fertilizers and pesticides causes severe environmental damage.

b. These chemical cause air pollution when sprayed; they also travel large distances via air and hence cause air pollution over a vast area.

c. Other agricultural facilities that contribute to air pollution by emission of air contaminants such as harmful gases and particulate matter include industries such as cottonseed oil mills, sugar mills, feed mills, smokehouses machines such as cotton gins and processes such as hide tanning, seed cleaning, sugarcane and crop-residue burning, etc.

vi. **Disposal of Garbage :** All types of biodegradable and non-biodegradable waste materials produce smoke and soot when burnt and hence cause air pollution.

b. Discuss in brief various pollution control acts.

Ans. Refer Q. 4(c), Page SQ–4Y, Solved Paper 2013-14.

c. Describe various methods of coping with solid waste.

Ans. Following are the methods of disposal of solid waste :

A. Composting :

1. Composting is the thermophilic and aerobic decomposition of organic matter present in solid waste by micro-organisms, mainly bacteria and fungi.
2. As a result of this composting process, the organic matter is transformed into stable humus like substance, which is valuable manure for crops.

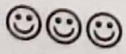
B. Sanitary Landfills :

1. Sanitary landfill sites have liner systems and other safeguards to prevent groundwater contamination.
2. These sites are consistent with the economic considerations, hydrogeological requirements, climatic conditions and topography.

C. Combustion : Solid waste is burned at high temperature in combustion facilities.

D. Incineration :

1. It is the controlled combustion of organic solid wastes so as to convert them into incombustible residue and gaseous products.
2. The weight and volume of solid waste is reduced and often energy is also produced.



B.Tech.
(SEM. VI) EVEN SEMESTER THEORY EXAMINATION, 2015-16
INDUSTRIAL MANAGEMENT

Time : 3 Hours **Total Marks : 100**

Section - A

1. Attempt **all** parts. Write answer of **each part** in short. (2 × 10 = 20)

a. What are the applications of industrial management ?

Ans. Refer Q. 1.4, Page SQ–1Y, Unit-1, Two Marks Questions.

b. Explain the term process control.

Ans. Refer Q. 4.7, Page SQ–12Y, Unit-4, Two Marks Questions.

c. What is flow diagram ?

Ans. Refer Q. 3.6, Page SQ–8Y, Unit-3, Two Marks Questions.

d. What is role of work study in improving productivity ?

Ans. Refer Q. 1.9, Page SQ–2Y, Unit-1, Two Marks Questions.

e. Explain productivity index.

Ans. Refer Q. 1.5, Page SQ–1Y, Unit-1, Two Marks Questions.

f. What do you mean by standard time ?

Ans. Refer Q. 3.7, Page SQ–8Y, Unit-3, Two Marks Questions.

g. Define method study. What are its objectives ?

Ans. Refer Q. 3.2, Page SQ–7Y, Unit-3, Two Marks Questions.

h. What is meant by economic order quantity ?

Ans. Refer Q. 3.16, Page SQ–10Y, Unit-3, Two Marks Questions.

i. What do mean by central line, upper control limit and lower control limit ?

Ans. Refer Q. 4.10, Page SQ–12Y, Unit-4, Two Marks Questions.

j. What is sequential acceptance sampling ?

Ans. Refer Q. 4.13, Page SQ–13Y, Unit-4, Two Marks Questions.

Section - B

2. Attempt **any five** questions from this section. (10 × 5 = 50)

a. Write detailed note on development and scope of industrial management.

Ans. **Development of Industrial Management :** Refer Q. 1.6, Page 1–4Y, Unit-1.
Scope of Industrial Management : Refer Q. 1.3, Page 1–3Y, Unit-1.

b. Discuss the need, construction and applications of control charts for variables.

Ans. Refer Q. 4.6, Page 4–7Y, Unit-4.

c. Define productivity. Explain different types of production systems with appropriate examples.

Ans. **Productivity :** Refer Q. 1.9, Page 1–6Y, Unit-1.
Types of Production System : Refer Q. 1.13, Page 1–9Y, Unit-1.

d. Explain the steps required in making time study.

Ans. Refer Q. 3.7, Page 3–6Y, Unit-3.

e. State and explain the objectives, importance of production planning. Do you consider outsourcing is a part of production planning ? Explain.

Ans. Refer Q. 3.14, Page 3–13Y, Unit-3.

f. Explain solid waste management and describe various methods of coping with solid waste.

Ans.

A. **Solid waste management :** The solid waste can be disposed to land or oceans. It can be recycled. But prior to disposal or recovery, it must be collected.

B. **Methods :** Refer Q. 5(c), Page SQ–10Y, Solved Paper 2014-15.

g. What do you understand by supply chain management ? Explain different components of supply chain.

Ans. Refer Q. 3(b), Page SQ–7Y, Solved Paper 2014-15.

h. Explain the difference between quality management and total quality management.

Ans. Refer Q. 4.17, Page 4–17Y, Unit-4.

Section-C

3. Attempt **any two** questions from this section. **(15 × 2 = 30)**

a. Define production planning and state its objectives. What are the various steps in production planning ?

Ans. Refer Q. 3.13, Page 3–11Y, Unit-3.

b. Define inventory control with its objectives and importance. Explain quantitative technique with EOQ model. How economic order quantity (EOQ) is derived ?

Ans. Refer Q. 3.19, Pag

4. a. What are the quality control

Ans. Refer Q. 4.3, Pag

b. Explain classifi inventory.

Ans. Refer Q. 3.18, Pa

5. a. What do you ur sources ? How

Ans. **Water Pollution** or energy in wat that tends to deg or any other orga but the use const **Source (Causes** water pollution a

1. **Natural Causes** decaying remain etc., are some of pollution.
2. **Man-made Cau** pollution are as f

i. **Sewage Dispos** cloth, soap, dete biodegradable ar into the water re

ii. **Industrial Wast** a wide variety of grease, plastic, r which are not rea pollution problen

iii. **Eutrophicatior**

a. Sewage disposa phosphorous con algal bloom in it.

b. This followed by oxygen in the wa unfit for survival aquatic ecosyster

iv. **Agricultural W**

a. Modern agricultu fertilizers, pestic

b. A variety of ferti water bodies thr cause pollution.

Ans. Refer Q. 3.19, Page 3–18Y, Unit-3.

4. a. What are the advantages and limitations of statistical quality control ?

Ans. Refer Q. 4.3, Page 4–4Y, Unit-4.

b. Explain classification, need and various costs involved with inventory.

Ans. Refer Q. 3.18, Page 3–17Y, Unit-3.

5. a. What do you understand by water pollution ? What are its sources ? How can we control it ? Discuss.

Ans. **Water Pollution :** It is defined as presence of any foreign substance or energy in water in such concentration and for such duration that tends to degrade the quality of water so that humans, animals or any other organism cannot enjoy the beneficial qualities of water but the use constitutes a hazard.

Source (Causes) of Water Pollution : The principal causes of water pollution are categorized into the following two types :

1. **Natural Causes :** Soil erosion due to rains, deposition of dead and decaying remains of plants and animals, high-speed winds, floods, etc., are some of the natural phenomena that contribute to water pollution.
2. **Man-made Causes :** Some of the man-made causes of water pollution are as follows :

i. **Sewage Disposal :** Sewage wastes include human excreta, paper, cloth, soap, detergent, etc. They may be biodegradable or non-biodegradable and may release a number of chemical substances into the water rendering it unfit for use.

ii. **Industrial Waste :** Effluents released from industrial units contain a wide variety of both inorganic and organic pollutants such as oil, grease, plastic, metals, acids, and other toxic chemicals, many of which are not readily susceptible to degradation and lead to serious pollution problems.

iii. **Eutrophication :**

a. Sewage disposal in water bodies results in high nitrogen-phosphorous content that triggers exponential growth of algae-algal bloom in it.

b. This followed by decay of the plants leads to severe depletion of oxygen in the water, thereby reducing its quality and making it unfit for survival of aquatic animals thus endangering the entire aquatic ecosystem.

iv. **Agricultural Waste :**

a. Modern agricultural practices require the use of large amounts of fertilizers, pesticides, biocides, and other soil additives.

b. A variety of fertilizers and pesticides such as DDT, slowly move to water bodies through irrigation, rainfall, and poor drainage, and cause pollution.

v. **Customs and Traditions :**

a. Disposal of dead bodies and immersion of idols of gods and goddesses into water bodies during various festivals of India degrade the quality of water.

b. Such water pollution can damage the ecosystem by killing aquatic plants and organisms and other living creatures dependent on the water.

c. Drinking such polluted water can cause breathing problems, affect digestion, and may cause blood impurities and skin diseases.

vi. **Thermal Power Stations :** Release of hot water from thermal power stations and various industries directly into water bodies may often kill both aquatic plants and animals, which may experience shock as a result of temperature variance.

Control of Water Pollution :

1. Water pipes should be properly checked for leaks and cracks.
2. Proper use of fertilizers and pesticides.
3. Dead bodies should not be burnt near the river.
4. Water used in thermal power plant should be cooled before discharge into the river.
5. By treatment of water which includes :

i. **Primary Treatment :** It includes screening, grit removal and sedimentation.

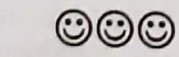
ii. **Secondary Treatment :** It includes the methods like activated sludge process, trickling filters etc.

iii. **Tertiary Treatment :** It includes removal of suspended solids, toxic substances, dissolved solids etc.

6. Enforce zero-emissions laws to protect water from pollutants and contaminants.
7. Support clean agriculture by preferably purchasing and consuming healthy organic foods. In the growing of organic food, no pesticide or other harmful contaminants are use.
8. Create awareness in public through media, child education, etc., for preventing water pollution.
9. Treat waste water (from domestic and industrial houses) before disposal.
10. Avoid littering in any form and prevent pollution caused by animals.
11. Conserve clean water supplies.

b. Describe the various methods of control of industrial pollution.

Ans. Refer Q. 4(b), Page SQ–2Y, Solved Paper 2013-14.



B. Tech.
(SEM. VI) EVEN SEMESTER THEORY EXAMINATION, 2016-17
INDUSTRIAL MANAGEMENT

Time : 3 Hours **Max. Marks : 100**

Section-A

1. Attempt **all** parts. All parts carry equal marks. **(2 × 10 = 20)**

a. What are the applications of industrial management in engineering ?

Ans. Refer Q. 1.4, Page SQ–1Y, Unit-1, Two Marks Questions.

b. Define Dayabhaga and Mitakashara system in joint Hindu family business.

Ans. Refer Q. 1.16, Page SQ–3Y, Unit-1, Two Marks Questions.

c. Differentiate between mass production and job production systems.

Ans. Refer Q. 1.17, Page SQ–4Y, Unit-1, Two Marks Questions.

d. What are therblig ?

Ans. A therblig is the name for one of a set of fundamental motions required for a worker to perform a manual operation or task. The set consists of 18 elements, each describing a standardized activity. The therblig is used in the study of motion economy in the workplace.

e. Define the term 'ergonomics'.

Ans. Ergonomics is defined as the relationship between man and machine and the application of anatomical, physiological and psychological principles to solve the problems arising from man-machine relationship.

f. Define statistical quality control.

Ans. Refer Q. 4.9, Page SQ–12Y, Unit-4, Two Marks Questions.

g. Differentiate between production and productivity.

Ans. Refer Q. 1.17, Page 1–13Y, Unit-1.

h. What is TQM (Total Quality Management) ?

Ans. Refer Q. 4.14, Page SQ–13Y, Unit-4, Two Marks Questions.

i. Enlist any two symbols of process chart.

Ans. Refer Q. 3.5, Page SQ–8Y, Unit-3, Two Marks Questions.

j. What do you understand by 'JIT' and 'Kanban system' ?

Ans. Refer Q. 3.17, Page SQ–10Y, Unit-3, Two Marks Questions.

Section-B

2. Attempt any **five** of the following questions : **(10 × 5 = 50)**

a. Write a detailed note on the development of industrial management.

Ans. Refer Q. 1.6, Page 1–4Y, Unit-1.

b. Is production management different from operation management ? Describe the intermittent and continuous production system.

Ans. Refer Q. 3.15, Page 3–14Y, Unit-3.

c. Define 'work study' and state its objectives. Differentiate between 'method study' and 'work measurement'.

Ans. Refer Q. 3.3, Page 3–3Y, Unit-3.

d. What are the basic principles of motion economy ? Discuss these principles in relation to work area.

Ans.

A. Principle of Motion Economy :

1. The principles of motion economy developed by Gilbreth envisage the correct application of theories behind motion elements to achieve synchronization of human body movements, best layout of workplaces and the optimum design of equipment and tools and time conservation.
2. There are four basic principles of motion economy which are listed below :

i. Principles related to human body.
ii. Principles related to the arrangement of work place.
iii. Principles related to design of tools and equipment.
iv. Principles related to time conservation.

B. Principles in Relation to Work Area :

1. Definite and fixed stations should be provided for all tools and materials to permit habit formation.
2. Tools and materials should be pre-positioned to reduce searching.
3. Gravity fed bins and containers should be used to deliver the materials as close to the point of use as possible.
4. Tools, materials and controls should be located within the maximum working area and as near to the worker as possible.
5. Materials and tools should be arranged to permit the best sequence of motions.
6. Drop deliveries or ejectors should be used wherever possible so that the operator does not have to use his hands to dispose of the finished work.
7. Provision should be made for adequate lighting and a chair of the type and height to permit good posture should be provided.
8. The height of the workplace and seat should be arranged to allow alternate standing and sitting.

9. The colou
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Ans.

A. ISO Cer

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B. Ways to

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Page 1–1
B. Advanta
i. Single O
ii. Partner
iii. Joint H
Unit-1.
iv. Public S

9. The colour of the workplace should contrast with that of the work and thus reduce eye fatigue.

e. Discuss the ISO certification norms. In what way can it help an organization to improve their internal efficiency ?

Ans.

A. ISO Certification Norms :

1. Evaluation of existing quality procedure against the needs of ISO 9001-03 standards.
2. Identification of corrective action needed to confirm with ISO-9000 series standards.
3. Preparation of a certificate quality management system.
4. Definition, documentation and implementation of new procedure.
5. Preparation of quality manual.
6. Pre-assessment meeting with registrar to evaluate quality manual.
7. Actual assessment visit.
8. Certification/Registration.

B. Ways to help an Organization to Improve their Efficiency :

1. ISO helps the company to :

i. Define clearly the need of the company.

ii. Specify the right components, processes, tools and equipments for the job.

iii. Distribute information to right people and at the right times.

iv. Achieve a system of management and control.

v. It provides a framework for continuous improvement in quality.

2. It enables the company to offer the very best service to its customers. It also gives a measure of product liability protection.
3. ISO automatically enables the company control of its production quality and delivery schedules, cut waste and downtime, and boost productivity.
4. To adopt ISO standards it is necessary to establish and maintain sound quality assurance system. This results in improvement in efficiency, and reduction in inspection; scrap and rework.
5. Motivates the employees and develops pride in them for achieving excellence.

f. What are the different patterns of industrial ownership ? Explain them with their advantages and disadvantages.

Ans.

A. Different Patterns of Industrial Ownership : Refer Q. 1.18, Page 1–14Y, Unit-1.

B. Advantages and Disadvantages :

i. Single Ownership : Refer 1.19, Page 1–14Y, Unit-1.

ii. Partnership : Refer 1.20, Page 1–15Y, Unit-1.

iii. Joint Hindu Undivided Family : Refer 1.21, Page 1–17Y, Unit-1.

iv. Public Sector : Refer 1.22, Page 1–18Y, Unit-1.

v. **Cooperative Societies :** Refer 1.23, Page 1–19Y, Unit-1.
vi. **Joint Sector :** Refer 1.24, Page 1–20Y, Unit-1.

g. **What is acceptance sampling ? Describe the single, double and sequential sampling plan procedure.**

Ans. **Acceptance Sampling :** Refer Q. 4.10, Page 4–11Y, Unit-4.
Single Sampling : Refer Q. 4.11, Page 4–12Y, Unit-4.
Double Sampling : Refer Q. 4.12, Page 4–12Y, Unit-4.
Sequential Sampling : Refer Q. 4.13, Page 4–13Y, Unit-4.

h. **Define the term production planning. State its objectives. What are the various steps involved in production planning and control ?**

Ans. Refer Q. 3.13, Page 3–11Y, Unit-3.

Section-C

3. Attempt any **two** of the following questions : **(15 × 2 = 30)**

a. **Who is referred as the father of scientific management ? What are the principles and goal of scientific management ?**

Ans. Refer Q. 2.4, Page 2–6Y, Unit-2.

b. **Explain the various types of inventory control techniques.**

Ans. Refer Q. 3.23, Page 3–22Y, Unit-3.

4. a. **What is a control chart ? Discuss the types of control charts for 'variables' (mean chart and range chart).**

Ans. Refer Q. 4.4, Page 4–5Y, Unit-4.

b. **What do you understand by 'supply chain management' ? Discuss the different components of supply chain ?**

Ans. Refer Q. 3(b), Page SQ–7Y, Solved Paper 2014-15.

5. a. **Describe the basic model of inventory control with its assumptions.**

Ans. Refer Q. 3.26, Page 3–25Y, Unit-3.

b. **The annual demand for an item is 3200 parts. The unit cost is ₹ 6 and the inventory carrying charges are estimated as 25 % per annum. If the cost of one procurement is ₹ 150. Find :**

i. **Economic order quantity,**
ii. **Numbers of order per year,**
iii. **The optimal cost.**

Ans. Refer Q. 3.21, Page 3–21Y, Unit-3.

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B. Tech.
(SEM. VI) EVEN SEMESTER THEORY EXAMINATION, 2017-18
INDUSTRIAL MANAGEMENT

Time : 3 Hours **Max. Marks : 100**

Note: Attempt **all** Sections. If require any missing data; then choose suitably.

Section-A

1. Attempt **all** questions in brief. **(2 × 10 = 20)**

a. Define productivity and formula to measure it.

Ans. Refer Q. 1.5, Page SQ–1Y, Unit-1, Two Marks Questions.

b. What are the applications of industrial management ?

Ans. Refer Q. 1.4, Page SQ–1Y, Unit-1, Two Marks Questions.

c. Write any five important uses of productivity measurements.

Ans. Refer Q. 1.6, Page SQ–2Y, Unit-1, Two Marks Questions.

d. Enlist any two symbols of process charts.

Ans. Refer Q. 3.5, Page SQ–8Y, Unit-3, Two Marks Questions.

e. Differentiate between inventory and stocks.

Ans. Refer Q. 3.13, Page SQ–9Y, Unit-3, Two Marks Questions.

f. Define method study. What are its objectives ?

Ans. Refer Q. 3.2, Page SQ–7Y, Unit-3, Two Marks Questions.

g. Discuss the different types of quality costs.

Ans. Refer Q. 4.3, Page SQ–11Y, Unit-4, Two Marks Questions.

h. What is meant by SQC, describe its importance ?

Ans. Refer Q. 4.9, Page SQ–12Y, Unit-4, Two Marks Questions.

i. Define JIT with example.

Ans. Refer Q. 3.17, Page SQ–10Y, Unit-3, Two Marks Questions.

j. Explain the concept and different parameters of quality.

Ans. Refer Q. 4.2, Page SQ–11Y, Unit-4, Two Marks Questions.

Section-B

2. Attempt any **five** parts of the following : **(10 × 3 = 30)**

a. Explain in detail the "scientific approach" to management and how it is helpful for organization ?

Ans. Refer Q. 2.3, Page 2–4Y, Unit-2.

b. Is production management different from operations management ? Describe the intermittent and continuous production system.

Ans. Refer Q. 3.15, Page 3–14Y, Unit-3.

c. Discuss the different types of ownership. Distinguish between limited and unlimited liability.

Ans. **Types of Ownership :** Refer Q. 1.18, Page 1–14Y, Unit-1.
Distinguish : Refer Q. 1.26, Page 1–22Y, Unit-1.

d. Explain the different costs involved in inventory models. Derive the expression for economic order quantity, when the demand of items is uniform model, the production rate is infinite and no stock-outs are allowed.

Ans. Refer Q. 3.19, Page 3–18Y, Unit-3.

e. Describe the method of constructing variable charts and attribute charts. And explain how these charts help in determining "lack of control".

Ans. Refer Q. 4.7, Page 4–8Y, Unit-4.

Section-C

3. Attempt any **one** part of the following : **(10 × 1 = 10)**

a. Explain the different types of inventory control techniques.

Ans. Refer Q. 3.23, Page 3–22Y, Unit-3.

b. What is a control chart ? Discuss the types of control charts for variables.

Ans. Refer Q. 4.4, Page 4–5Y, Unit-4.

4. Attempt any **one** part of the following : **(10 × 1 = 10)**

a. Give a historical view on industrial management. Also explain the recent developments, taken place in the field of IM.

Ans. Refer Q. 1.8, Page 1–6Y, Unit-1.

b. Mention the importance of EOQ for any organization.

Ans. Refer Q. 3.22, Page 3–21Y, Unit-3.

5. Attempt any **one** part of the following : **(10 × 1 = 10)**

a. Demarcate between the administrative and bureaucratic principles management.

Ans.

A. Administration :

1. Administrative management was the brainchild of Frenchman Henri Fayol, who argued that the success of an organization depended more on the administrative ability of its leaders than on their technical ability.
2. Out of that postulate, Fayol developed 5 management functions (planning, organizing, coordinating, commanding, and controlling) and 14 principles of management (division of work, authority and responsibility, discipline, unity of command, unity of direction, subordination of individual interests to the general interest, remuneration, centralization, scalar chain, order, equity, stability of tenure of personnel, initiative, and esprit de corps).
3. He is also known for his belief that management could and should be taught to others.

B. Bureaucracy :

1. German sociologist Max Weber is credited with the development of bureaucracy and bureaucratic management theories.
2. That is, running organizations on the basis of knowledge, fairness, and logical rules and procedures rather than on the basis of nepotism, the prospects for personal gain, and arbitrary decision making.
3. Bureaucracies are characterized by seven elements: qualification-based hiring; merit-based promotion; chain of command; division of labour; impartial application of rules and procedures; all administrative decisions, acts, rules, or procedures are recorded in writing; and managers are separate from owners.
4. Nonetheless, bureaucracies are often inefficient and can be highly resistant to change.

b. What is acceptance sampling ? Describe the single, double and sequential sampling procedures.

Ans. **Acceptance Sampling :** Refer Q. 4.10, Page 4–11Y, Unit-4.
Single Sampling : Refer Q. 4.11, Page 4–12Y, Unit-4.
Double Sampling : Refer Q. 4.12, Page 4–12Y, Unit-4.
Sequential Sampling : Refer Q. 4.13, Page 4–13Y, Unit-4.

6. Attempt any **one** part of the following : **(10 × 1 = 10)**

a. "Supply chain is the network of autonomous and semi-autonomous business entities." Comment.

Ans.

1. There seems to be a universal agreement on that a supply chain is a network of autonomous or semi-autonomous business entities collectively responsible for procurement, manufacturing, and

distribution activities associated with one or more families of related products.

2. A supply chain is a 105 network of facilities that procure raw materials, transform them into intermediate goods and then finished products, and then finally deliver the products to customers through a distribution system or a chain.
3. Moreover we can also express that a supply chain is a network of facilities and distribution options that performs the functions of procurement of materials.
4. This also transforms these materials into intermediate and finished products, and finally the distribution of these finished products to customers.
5. This network is consists of all parties involved directly or indirectly in fulfilling a customer request.

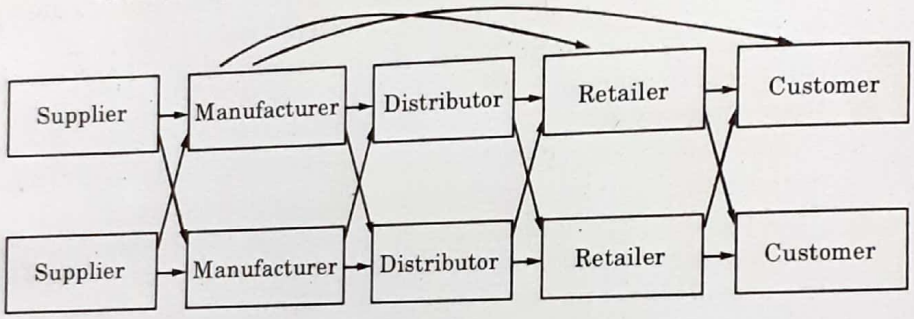

Fig. 1.

b. Explain total quality management. Discuss various statistical tools used for quality control and improvement.

Ans. Refer Q. 4.16, Page 4–16Y, Unit-4.

7. Attempt any **one** part of the following : **(10 × 1 = 10)**

a. Define the term production planning. State its objectives. What are the various steps involved in production planning and control ?

Ans. Refer Q. 3.13, Page 3–11Y, Unit-3.

b. Joint stock company does not suffer from the limitations of capital and management. Justify.

Ans. Refer 1.29, Page 1–23Y, Unit-1.

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