Introduction to Industrial Management (Humanities III)
HSMC-501

Bachelor of Technology
Computer Science and Engineering

Submitted By

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REG. No. : **211300100110045** OF 2021-22
CSE (2021-2025) , SEMESTER - 5

SEPTEMBER 2023

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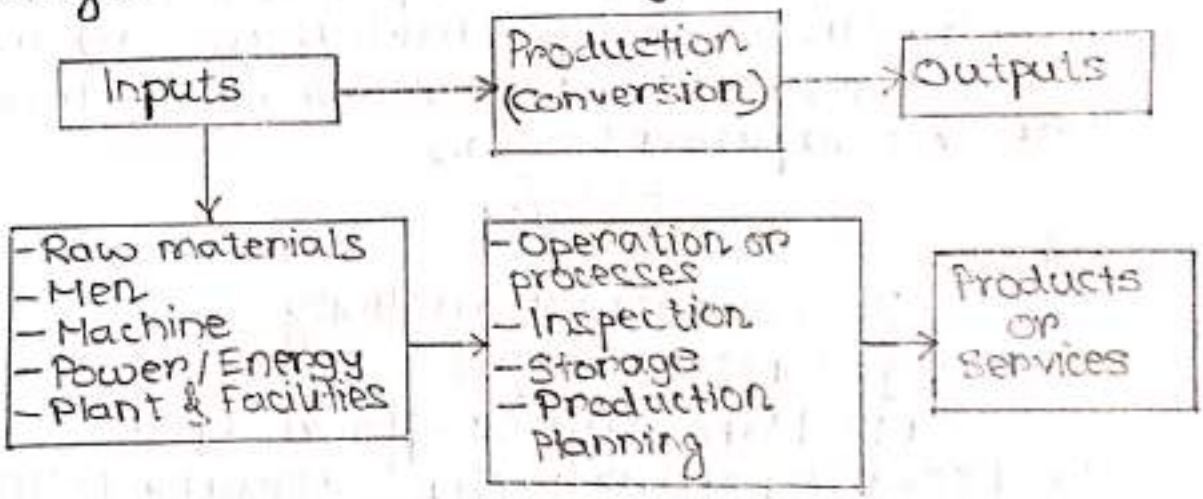
CSE SEM 5

1. What is production and productivity?

Ans→ Production is an organised activity of converting raw materials into useful products by organised utilisation of natural resources, men, money, materials and machines. Whereas in the input Conversion-output sequence the smallest unit of productive activity is termed as operation. Production is a process developed to transform a set of inputs like men, materials, money, machinery and energy into a specified set of outputs like finished products and services in desired quantity and quality to achieve the objectives of the enterprise. The production system is a part of larger system - the business system.



PRODUCTION SYSTEM

For production control we adopt two types of production

I. Intermittent production:
In intermittent production machinery is used for a short duration of time for producing an item and then changed to produce another item.

II. Continuous production:
Set up of production is fixed and used to produce same item.

Intermittent production can be subdivided into Job production and Batch production. Continuous production can be subdivided into mass production and process production

P.T.O

Productivity is nothing but reduction in wasting of resources. The resources may be men, machine material, power, space, time and building etc. It may also be defined as human endeavour to produce more and more with less and less inputs of resources as a result of which the benefits of production may be distributed more equally among maximum number of people. Output is obtained by the combined input of a number of factors such as men, material, money, land, management and production methods etc. The ratio between output and input of these factors is known as productivity. The most common unit of input is man-hour. Of working time and productivity due to this factor is known as labour productivity. It can be represented as

$$P = Q/M$$

where,

P = Labour productivity
Q = Unit of output
M = Man-hour or efforts input

To increase productivity, following major items need fullest control and should be minimized.

a) Wastage of materials
b) Machine breakdown
c) Waiting on part of men and women
d) Excessive handling
e) Poor management
f) Poor working conditions
g) Political effects.

P.T.O

2. Explain critical path method with numerical example

Ans → The critical path method is a step by step procedure for scheduling the activities in a project. It is an important tool related to effective project management. The iterative procedure of determining the critical path is as follows:

Step 1: List all the jobs and then draw an arrow diagram. Each job is indicated by an arrow with the direction of the arrow showing the sequence of jobs.

Step 2: Indicate the normal time (t_{ij}) for each activity (i,j) above the arrow, which is deterministic.

Step 3: Calculate the earliest start time and the earliest finish time for each event and write the earliest time E_i for each event in the □. Also calculate the latest finish and start time. From this we calculate the latest time L_j for each event j and put it in the Δ.

Step 4: Tabulate the various times, namely, normal time, earliest time and latest time on the arrow diagram.

Step 5: Determine the total float for each activity by taking the difference between the earliest start and the latest start time.

Step 6: Identify the critical activities and connect them with the beginning and the ending events in the network diagram by double line arrows. This gives the critical path.

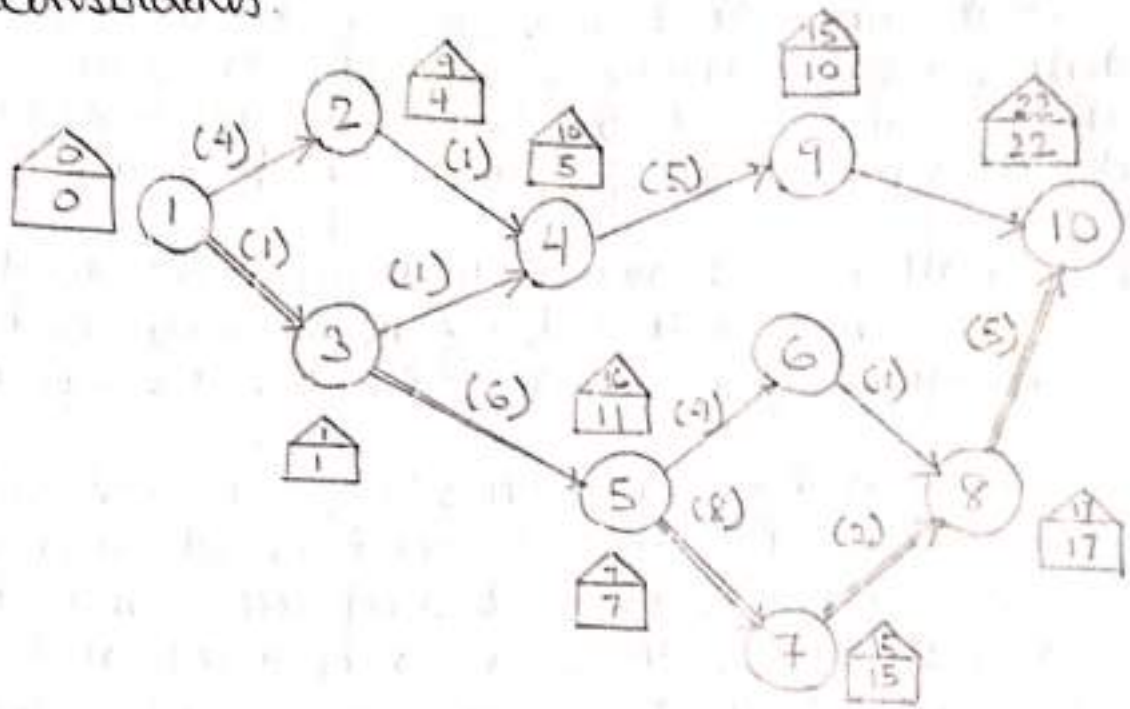
Step 7: Calculate the total project duration.

Let us take an example:

A project schedule has the following characteristics

Activity	1-2	1-3	2-4	3-4	3-5	4-9	5-6	5-7	6-8	7-8	8-10	9-10
Time	4	1	1	1	6	5	4	8	1	2	5	7

First we construct the network with the given constraints.



The following table gives the critical path as well as total and free floats calculation.

Activity	Normal time	Earliest		Latest		TF	FF
		Start	Finish	Start	Finish		
1-2	4	0	4	5	9	5	0
1-3	1	0	1	0	1	(0)	0
2-4	1	4	5	9	10	5	0
3-4	1	1	2	9	10	8	3
3-5	6	1	7	1	7	(0)	0
4-9	5	5	10	10	15	5	0
5-6	4	7	11	12	16	5	0
5-7	8	7	15	7	15	(0)	0
6-8	1	11	12	16	17	5	0
7-8	2	15	17	15	17	(0)	0
8-10	5	17	22	17	22	(0)	0
9-10	7	10	17	15	22	5	5

P.T.O

The earliest and latest calculations are shown below.
Forward pass calculation: In this we estimate the earliest start (ESi) and finish times (ESj). The earliest time for the event i is given by

$E_i = \text{Max}(ES_i + t_{ij})$

$ES_1 = 0 = E_1 = 0$

$E_2 = ES_2 = ES_1 + t_{12} = 0+4 = 4$

$E_3 = ES_3 = ES_1 + t_{13} = 0+1 = 1$

$E_4 = ES_4 = \text{Max}(ES_3 + t_{34}, ES_2 + t_{24})$
$= \text{Max}(1+1, 4+1) = 5$

$E_5 = (E_3 + t_{35}) = 1+6 = 7$

$E_6 = E_5 + t_{56} = 7+4 = 11$

$E_7 = E_5 + t_{57} = 7+8 = 15$

$E_8 = \text{Max}(E_6 + t_{68}, E_7 + t_{78})$
$= \text{Max}(11+1, 15+2) = 17$

$E_9 = E_4 + t_{49} = 5+5 = 10$

$E_{10} = \text{Max}(E_9 + t_{9,10}, E_8 + t_{8,10})$
$= \text{Max}(10+7, 17+5) = 22$

Backward pass calculation: In this we calculate the latest finish and the latest start time. The latest time L for an event i is given by $L_i = \text{Min}(LF_j - t_i$ where LFj is the latest finish time for the event j, tij is the normal time of the activity.

$L_{10} = 22$

$L_9 = L_{10} - t_{9,10} = 22-7 = 15$

$L_8 = L_{10} - t_{8,10} = 22-5 = 17$

$L_7 = L_8 - t_{7,8} = 17-2 = 15$

$L_6 = L_8 - t_{6,8} = 17-1 = 16$

$L_5 = \text{Min}(L_6 - L_{5,6}, L_7 - t_{5,7})$
$= \text{Min}(16-4, 15-8) = 7$

$L_4 = L_9 - t_{4,9} = 15-5 = 10$

$L_3 = \text{Min}(L_4 - t_{3,4}, L_5 - t_{3,5})$
$= \text{Min}(10-1, 7-6) = 1$

$L_2 = L_4 - t_{2,4} = 10-1 = 9$

$L_1 = \text{Min}(L_2 - t_{12}, L_3 - t_{13})$
$= \text{Min}(9-4, 1-1) = 0$

P.T.O

To find the TF (Total Float): Considering the activity 1-2, TF of (1-2) = Latest start - Earliest start = 5-0=5
Similarly, TF (2-4) = LS - ES = 9-4 = 5
Free float = TF - Head event slack
Consider the activity 1-2
FF (1-2) = TF (1-2) - Slack for the head event 2
= 5-(9-4) = 5-5=0
FF (2-4) = TF of (2-4) - Slack for head event 4
= 5-(10-5) = 5-5=0
Like this we calculate the remaining TF and FF for the remaining activities.
Hence we have the following critical path 1-3-5-7-8-10 with total project duration of 22 days.

3) What do you mean by PERT? Explain the features of networking where we apply PERT?

Ans→ PERT stands for Program Evaluation and Review Technique. It is a project management method used to analyze and plan tasks within a project. PERT helps in estimating the time required to complete various activities and identifies the critical path, which is the sequence of tasks that determines the minimum time needed to complete the project. PERT involves breaking down a project into individual tasks, estimating the time required for each task and determining the dependencies between tasks. This information is then used to create a network diagram that visualizes the sequence of tasks and their relations.

Networking in industrial management involves the use of interconnected devices and systems to enhance operations and communications with industrial settings. Key features include:

I. Remote Monitoring and Control: Industrial networks enable remote monitoring and control of machinery, processes and equipment.

II. Data Collection and Analysis: Networking facilitates the collection of data from various sensors and devices.

III. Process Automation: Networking enables the automation of various processes leading to increased efficiency and reduced human intervention.

IV. Interconnected Systems: Different industrial systems can be interconnected, allowing seamless communication between various departments like production, logistics, and quality control.

V. Scalability: Industrial networks can be designed to accomodate growth and changes in the production environment.

P.T.O

Applications of PERT include.

a) Large communication projects: PERT is widely used in construction projects that involve numerous tasks such as building construction infrastructure development and facility expansion.

b) Research and Development Projects: PERT helps in managing such projects by providing a structured approach.

c) Product development: PERT helps in estimating time required for each development stage

d) Event Handling: PERT can be applied to plan and manage large scale projects

e) Disaster Recovery planning: PERT can be applied in disaster recovery planning to estimate the time required to restore systems and operations after a catastrophic event.

P.T.O

4) What do you mean by material control? In this context discuss ABC analysis.

Ans→ Material control refers to the systematic management of materials and inventory within an organisation to ensure that the right quantity of materials is available at the right time and right place. It involves various processes, including procurement storage, distribution and inventory management. Effective material control helps optimise inventory levels, reduce carrying costs and prevent stockouts or overstock situations.

ABC analysis also known as ABC inventory classification method, it is a technique used in material control to categorise items based on their value and significance in terms of usage cost and impact on operations. The ABC analysis divides items into three categories:

a) Category A (High-Value Items): This category includes items that have the highest value in terms of cost or importance to the organisation even if they represent a relatively small portion of the total number of items.

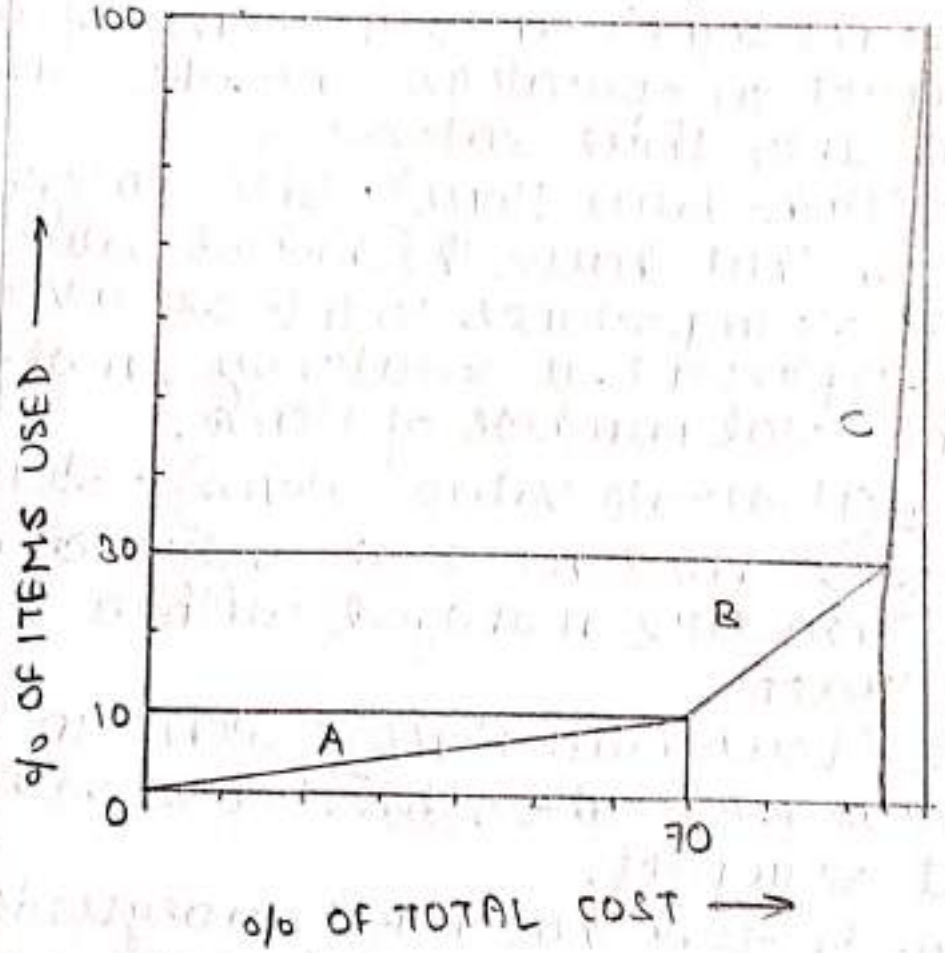
b) Category B (Moderate Value Items): Items in this category have moderate value and significance. They are managed with a balanced approach.

c) Category C (Low-Value items): Items in this category ~~have moderate value~~ have lowest value in terms of cost or impact.

It is necessary to clear that A-B-C analysis does not depend on the unit of cost of the items but on its annual consumption. Further it also clarified that it does not indicate importance of any item or category and every item is equally important.

P.T.O

If all the stare items of an undertaking are analysed in terms of annual consumption of each item in rupees, it will be found that nearly 10 percent of the items are responsible for about 70 percent of total annual consumption about 20 percent items will require about 25 percent of the total annual consumption cost. and the rest 70 percent of the items require only 5 percent of the total annual consumption cost. The first category small number of high consumption cost items are called A items; second category of medium consumption value items are known as B items; while the third category; ie large number of items with small annual consumption cost are C items.



5) What is EOQ? How can you derive EOQ?

Ans→ The evaluation of the most economic quantity to be purchased involves calculation of the following two costs. EOQ stands for Economic Ordering Quantity

a) Procurement cost or buying cost. Set up cost in case of manufacturing.

b) Inventory carrying cost.

Procurement cost includes the expenditures made on

i) Calling quotations
ii) Procuring quotations
iii) Placing purchase orders
iv) Receiving and inspecting
v) Verifying and payment of bills.
vi) other Incidental charges etc.

Inventory carrying cost includes the expenditure

i) Insurance
ii) Storage and handling
iii) Obsolescence and depreciation
iv) Deterioration
v) Taxes
vi) Interest etc.

The economic ordering quantity is obtained by the quantity where procurement cost is equal to inventory carrying cost.

Let A = Total items consumed per year
P = Procurement cost per order
e = Annual Inventory carrying cost/unit
= Unit cost x Inventory carrying charges
= C x I
Q = Economic order quantity

Let y = Total cost of one year's requirement

Then, Total cost
= (number of lots) x procurement cost +
(consumption quantity x varying cost/unit) +
(average inventory cost x Inventory carrying charges)

P.T.O

$$y = (A/Q * P) + A * C + (Q/2 * C * I) \quad \cdots (1)$$

∴ This equation can be used to determine the total cost.

By differentiating wrt Q and equating equation (1) to zero, the economic purchase order is obtained

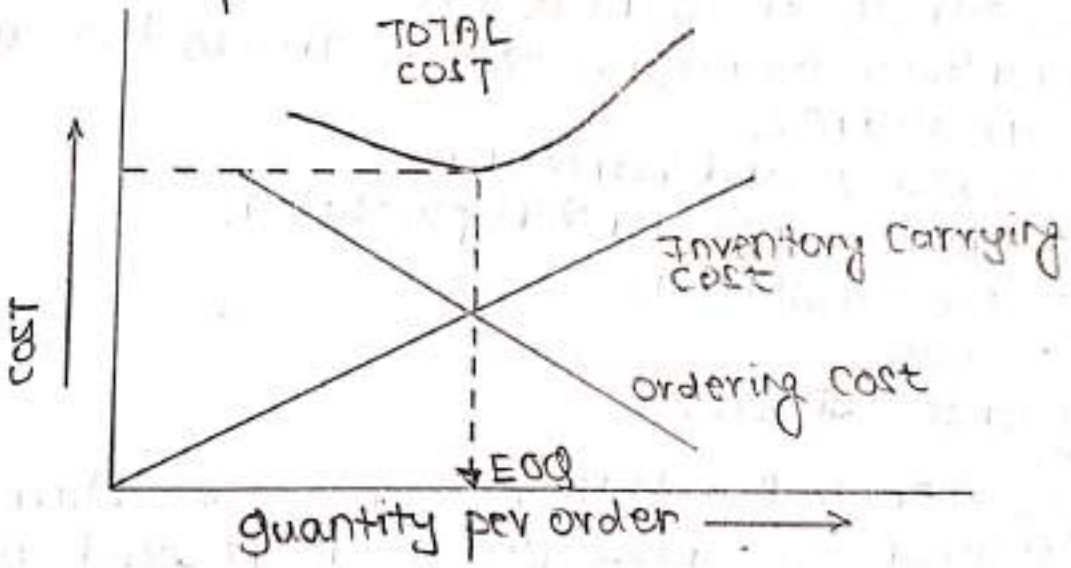
Thus $\frac{-AP}{Q^2} + \frac{C \times I}{2} = 0$ or $\frac{AP}{Q^2} = \frac{C \times I}{2}$

Therefore, $C \times I = e$

or $Q^2 = \frac{2AP}{e}$

or $Q = \sqrt{\frac{2AP}{e}} = \sqrt{\frac{2AP}{C \times I}} \quad \cdots (2)$

Using (1) & (2), the most economical purchase order size and the minimum total cost for a given set of conditions can be obtained.



ECONOMIC ORDERING QUANTITY

Since the total cost curve is flat at the bottom we can deviate upto 25 percent on either side of the economic ordering quantity, without any significant extra cost, depending upon the circumstances. Here purchase price and cost parameters (P, C) are constant.