

Notes by-

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CONSTRUCTION MANAGEMENT

ASSIGNMENT NO. 02

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Assignment No.2

22/07/03.

- 1) Define material management has been accepted by International Federation of Purchasing & Material Management. Enlist objectives of material mgt.

Materials mgt is a total concept involving an organisational str. unifying in to a single responsibility the systematic flow & control of matl. from the identificatⁿ of need through consumers delivery.

Include within this concept are the material functions of planning, scheduling, buying, storing, moving, distributing. These are logically represented by the disciplines of production & inventory control, purchasing & physically distribution.

The objectives of matl. mgt. is to contrabute to increase profitability by coordinating achievement of least matls. cost. This is done through optimising capital investments, capacity & personnels consistant with the appropriate customer service level.

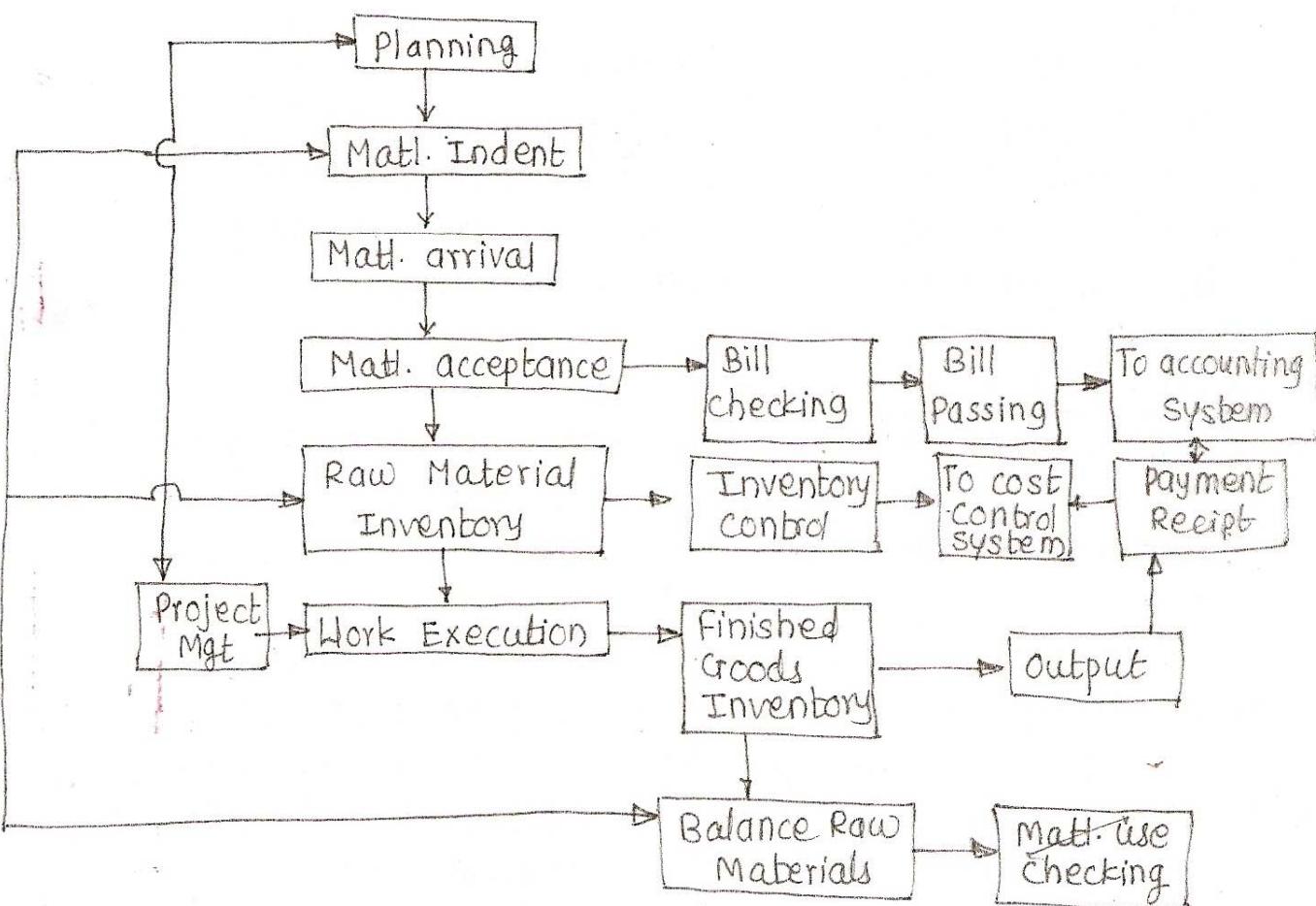
Objectives of matl. mgt: →

- 1) To ensure continuous & uninterrupted production or operatⁿ, by maintaining by a steady flow of matls.
- 2) To achieve the above objectives in efficient & economical manner.
- 3) To effect economics in the cost of materials by purchasing matls, of right quality, in the right quantity, at the right time, from the right source & at the right price.
- 4) To effect economics, in the cost incurred on matls, after they have been purchased, through storage, processing, & wear house, till the finished goods ultimately reach the customer.
- 5) To reduce working capital requirements through proper

{ scientific inventory control.

- 6) To improve the quality of manufactured goods by use of better raw materials or components & thereby increase the competitiveness of manufactured goods.
- 7) To increase the competitiveness of manufactured goods by reducing their prices through cost reduction & value analysis.

Q.2] Explain with the help of flow chart, the entire process of material management.



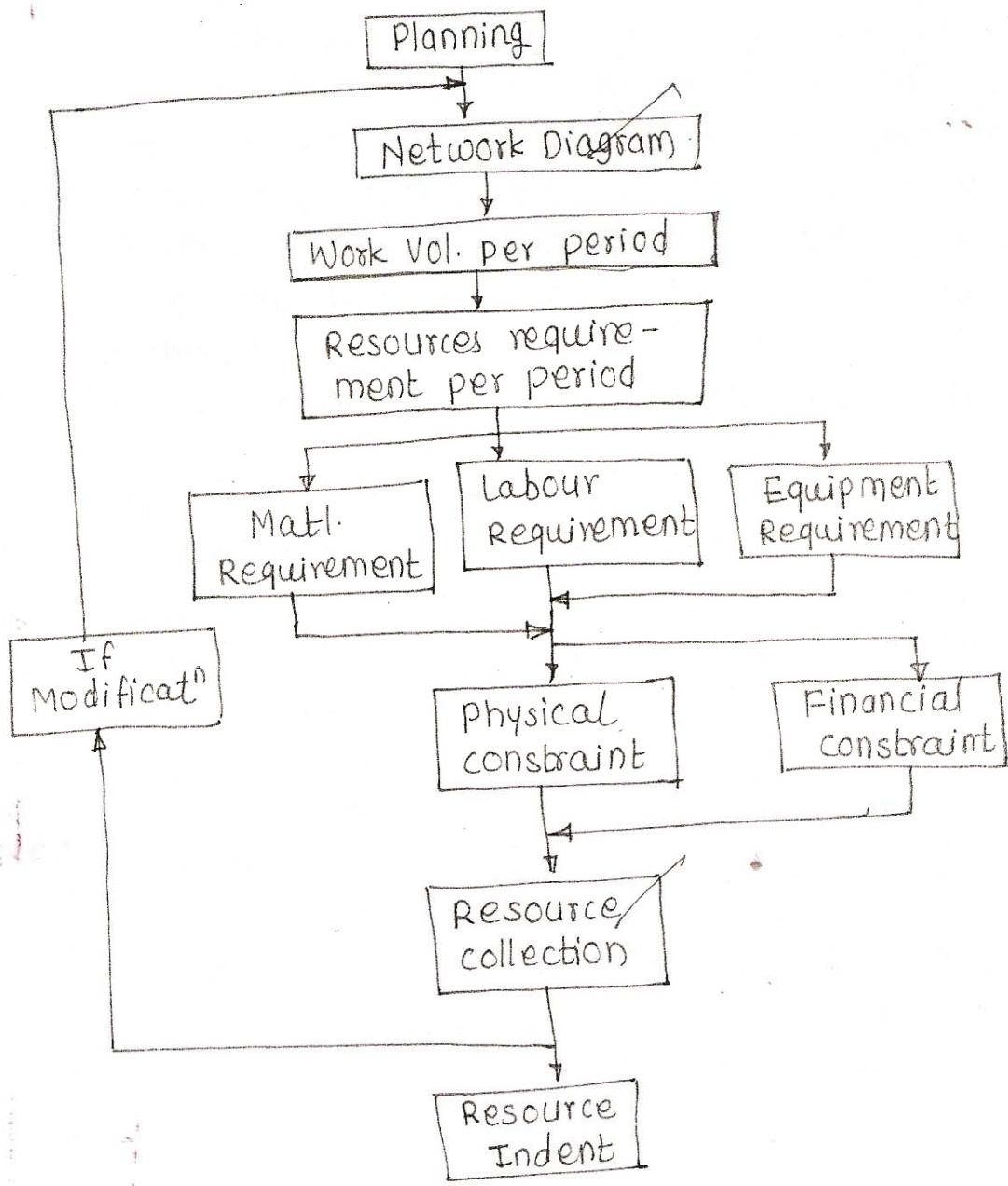
Flow diagram of material management.

Fig (1)

Matl. mgt. concerned with ensuring that the quantity & quality reqd, are on the job as per requirement. The constⁿ manager is concerned about the No. of matl. handling problems like quality, quantity, price, delivery date, mode of transportation, inspection, counting test, storage & protection. Considerable time & effort is spent on a practical network that will satisfy time & resource limitation. However such a schedule is not used unless supported by the timely delivery of matls.

Early procurement may have a beneficial effect on cost execution which could be easily neglected by capital blocking, storage problem & pilferage. A flow diagram of matl. procurement is shown in fig (1).

In the flow diagram of matl. indent is based upon planning. The proceeding steps are presented as shown in [fig. (2) ... Next page]. The raw matls. are continuously processed to the finished goods inventory. Matl. mgt. is namely consult with the indent, arrival & inventory of the raw matl. The matl. mgt. is also related to matl. usage, accounting system & cost control system as shown in fig (1).



Flow diagram of Resource management
 (fig. No. 2)

Q.3] Define inventory & cost of inventory:-

→ Inventory :- आवृत्ति

Every one, be it a firm, or an establishment, or an individual, is familiar with the word stock because each of these carry some items to meet their requirements.

In trade & industry, the word stock is called as inventory.

✓ Cost of inventory:-

The costs affected by company's Inventory policy are-

- 1] Inventory carrying cost
- 2] Procurement cost
- 3] Set-up cost
- 4] stock-out cost

1] Inventory carrying cost:-

Following elements contribute inventory carrying cost

a) Capital cost :- It is an important item in determining the cost of carrying inventory. Capital cost is either the cost of borrowing capital or the cost of diverting company's fund to invest in inventories. The former means the interest rate, the latter implies the foregone opportunity cost.

There are thus two mtds. of determining the capital cost. In first method is to use the bank leading rate, if the money is were to be borrowed. The other method is to consider the opportunity cost of the money.

$$R.O.R. = \frac{\text{Net profit before taxes}}{\text{Total capital}}$$

b) Storage Cost:- It includes cost of storage space (i.e. annual rent or depreciation), cost of maintenance, & repairs. Cost of storage facilities (i.e. racks, bins etc), cost of preservation (i.e. rust prevention, oil, greases), cost of record keeping & cost of periodic/annual stock verification etc.

$$EOQ = q_0 = \sqrt{\frac{2SCP}{cu \cdot i}}$$

Deterioration & obsolescence:-

Deterioration is the loss from reduction in the inventory value due to one or more of the following reasons -

- 1) The part / item / matt. may have limited shelf life and hence may deteriorate if stored for a long time, e.g. rubber parts may crack after approx. 6 months life, ammonia sheets may spoil if stored beyond 3 months etc.
- 2) The items also deteriorate when storage conditions are inadequate, unsatisfactory or both. Some of the parts may get damp, dried up, or spoiled. e.g. cement may get damp & solidify, steel may become rusty.
- 3) Deterioration can also result from poor handling in stores. Some of the fragile items (electric bulbs, fluorescent tubes etc) may collide with other & break.

सहज मोडनाव, नए होमाव.

Obsolescence is the loss from reduction in inventory value of the items/ components that are rendered unusable by the company due to changes in design or due to the development in the field.

$$\text{Deterioration & obsolescence} = \frac{(1-P) \Sigma A}{n}$$

Avg. Inventory investment

Where P = The proportionate amount that can be realised if the items were to be disposed off.

A = All obsolete & non-moving item multiplied by quantity on hand with unit price.

n = No. of years.

d) Insurance cost:-

Inventories like other assets, are covered by insurance. Insurance cost is thus the premium paid or payable to cover the company against loss due to unforeseen acts such as fire, theft etc.

2] Procurement cost: → खुशबूद्धी करने, आवश्यकी गोष्ठे आणणे.

Procurement cost is also called as 'ordering cost', 'replenishment cost', or 'recoupment cost'. is the cost incurred to replenish the stock of an item.

Basic elements of procurement cost are as follows-

a) Paper work cost:

The procurement function is built around paper work since all orders - small or big - need paper work! Purchasing function sets out with paper work (matls. requisitions), pushes through paper work (enquiry forms, purchase order forms, goods receipt notes, inspection notes, store receipts notes) & end up with paper work (cheques to pay suppliers invoices). The requirement of paper work varies directly with the order frequency

& its cost is considered as one of the elements of procurement cost.

b) Postage Cost :-

Postage cost is the cost expended to mail documents necessary for the business transactions. Purchase orders are sent to authorise vendors to supply the goods, delivery schedules are mailed to communicate immediate as well as future requirements, amendments to purchase orders are issued to alter / modify quantity, price or other terms; goods inspection notes are posted to acknowledge receipts of matls. & inform inspection results.

c) Follow up Cost :

Follow up is the function of seeing that the suppliers effect deliveries ~~on~~ time. The follow up funct' now a days has become the foremost f' of the buyers. Venders, be it a small manufacturer, a trader, or a supplier at a distance takes little initiative in delivering the goods on time.

d) Cost of visits to the vendor's plants :-

Follow up with the vendors at times requires visits by purchase personnel & therefore costs of such visits are considered towards procurement cost.

e) Expenditing cost :

Follow up with the vendor's enables buyer to secure advance information of expected delays.

Pre-delivery follow up enables buyer -

- To make alternate arrangement (i.e. request order other supplier for early delivery.)
- To decide expedited routing of goods from suppliers.

f) operating cost of the vehicles:-

Vehicles are employed for collection & delivery of materials from / and to the vendors , collection of materials from transporter's / Railway godown's etc. The operating cost of such vehicles should be considered.

g) Inspection & Testing costs:-

Inspection & testing costs to include cost of destructive tests. Too frequent purchases increases inspection costs.

h) Administrative cost:-

Purchase is major function & it requires performance of a No. of activities. Indents are raised to inform the purchase dept. of the impending need ; enquiries are floated , quotations are received ; rates are compared ; terms of payment are looked into and then an order is placed on a supplier whose terms are attractive ; progress on the order is received and follow up with suppliers is done.

3] Set up cost:-

Set up cost is also called 'preparatory cost' is the cost that is incurred to replenish the stock of an item manufactured at the home plant. It is the cost of production stoppage to enable a machine or a group of machines to change over from one job to

another. & is dependent of the quantity to be produced.

The following are major elements of this cost -

a) Idle time cost:

It is the loss due to inability of the company to produce during the period the machine is under set up and it equals the product of the set up time (It is total time necessary to prepare a machine for the production of good pieces) (in hours) & the machine hour rate.

b) Cost of idle wages:-

cost of idle wages paid to the direct worker(s) for the period the machine is under preparation & it equals the product of set up time (^{maintenance} in hours) and workers hourly rate (in Rs.)

c) Work order cost:-

This Cost is the cost of raising a work order & other auxillary orders namely stores issue order, move order, inspection order, goods forwarding note etc. to authorise shop to undertake manufacturing activity.

The work order cost also includes the cost of blue prints of the process sheets & operational layouts to enables shops to know as to what & how to manufacture.

d) Foregone Profit:-

Foregone profit cost implies loss in profit for the time of machine is under preparation & is equal to the product of the sum of machine

idle time cost & cost of idle wages & company's rate of return on investment. i.e.

$$\text{Foregone Profit} = \left[\frac{\text{Machine Idle time cost}}{\text{wages}} + \text{cost of idle wages} \right] \times \left[\frac{\text{Rate of Return on investment}}{\text{on investment}} \right]$$

4) Stock out Cost:-

Stock out represents a situation of non-availability of the item at the time when it is required. Stock out results when the stock of the item gets depleted before the receipt of fresh supply. One or more of the following occurrences may cause stock out.

- i) Usual Unusual higher demand rate during the replenishment lead time.
- ii) Delay in delivery
- iii) Transportation delays.
- iv) Rejection in the incoming consignment.

The following are major elements of stock out cost-

Q.4] A construction machinery manufacturing company needs 12,000 bearing of concrete mixture in a year. The cost of single bearing is Rs 80/No. and the carrying cost is 12% of unit cost. The ordering cost Rs 150/- per order. Find EOQ & also find total cost for operating inventory.

Sol:- Economic Order Quantity (EOQ) is given by the formula,

$$q_0 = \sqrt{\frac{2 \cdot S \cdot C_p}{C_u \cdot i}}$$

Where, S = Annual consumption (units)

$$= 12,000 \text{ No.}$$

C_p = Procurement cost per order (Rs)

= Rs 150/- per order.

Cu \Rightarrow Price or cost per unit (Rs)

= Rs 80/-

i = Inventory carrying cost per year-(decimals)

$$= \frac{12 \times 80}{100} = 0.12 \times 80 = 9.6$$

∴ Substituting the values in the EOG formula, we get,

$$q_0 = \sqrt{\frac{2 \times 12000 \times 150}{80 \times 0.12 + 9.6}}$$

$$= 612.37 \quad 68.46$$

≈ 613 No.

ii) Annual Total Cost (ATC):-

$$ATC = \frac{S}{q_0} \cdot Cp + \frac{q_0}{2} \cdot Cu \cdot i$$

Where q = Order quantity (No.)

$$\begin{aligned} \therefore ATC &= \frac{12,000}{612.37} \times 150 + \frac{612.37}{2} \times 80 \times 0.12 + 9.6 \\ &= 5878.78/- \\ &= 52581.36/- \end{aligned}$$

Q.5] A diesel Engine manufacturer buys an item in lot of 500 units which is a three months requirements.

The cost per unit is Rs 90/- & the ordering cost is Rs 180/- per batch order. The inventory carrying cost is estimated at 20% of the average inventory investment.

- What is the annual total cost of the existing inventory policy ?
- How much money can be saved by using economic order quantity ?

a) Annual total cost of the existing inventory policy :-

$$ATCe = \frac{S}{q} \times Cp + \frac{q}{2} \cdot Cu \cdot i$$

Where, S = Annual requirement (Units)

$$= 500 \times 4$$

$$= 2000 \text{ Nos.}$$

Cp = Procurement cost per order.

$$= \text{Rs } 180/-$$

Cu = Price or cost per unit.

$$= \text{Rs } 90/-$$

i = Inventory carrying cost per annum.

$$= 0.20$$

q = Order quantity per replenishment order
 under the existing inventory policy
 $= 500$ Nos.

∴ Substituting the values we get,

$$ATCe = \frac{2000 \times 180 + 500 \times 90 \times 0.20}{500}$$

$$= 5,200/-$$

b) Annual total cost due to economic order quantity purchase (ATCo) :-

$$ATCo = \frac{S \cdot Cp}{q_0} + \frac{q_0 \cdot Cu \cdot i}{2}$$

Where, $q_0 = \sqrt{\frac{2 \cdot S \cdot Cp}{Cu \cdot i}}$

$$= \sqrt{\frac{2 \times 2000 \times 180}{90 \times 0.20}}$$

$$= 200 \text{ Nos.}$$

$$\therefore ATCo = \frac{2000 \times 180}{200} + \frac{200 \times 90 \times 0.20}{2}$$

$$= Rs 3600/-$$

∴ Annual saving if EOQ purchases are made in place of quarterly purchases = $ATCe - ATCo = 5200 - 3600$
 $= Rs 1600/-$

Q.6] Monthly requirement of switch boards by a constⁿ company is 560 No's, with Rs 35/- as procurement cost & Rs 1.20/- per unit per year as holding cost. Determine quantity that should be procured at a time to optimise the cost involved. If the consumptⁿ of switch board increases to 40 No's per day & its inventory carrying cost is Rs 0.022/- per unit, per day, considering 300 working days in a year, what shall be received EOQ in this case?

Sol:- Given data:

$$S = \text{annual requirement (Units)}$$

$$= 560 \times 12$$

$$= 6720 \text{ No's.}$$

$$C_p = \text{Procurement cost per order}$$

$$= \text{Rs } 35/-$$

$$C_h = \text{holding cost}$$

$$= \text{Rs } 1.20 \text{ per unit per year.}$$

∴ The quantity that should be procured at a time to optimise the cost involved is given by-

$$q_0 = \sqrt{\frac{2 \cdot S \cdot C_p}{C_h}}$$

∴ Substituting the values of parameters, we get,

$$q_0 = \sqrt{\frac{2 \times 6720 \times 35}{1.20}} = 626.1 \text{ No's.}$$

b) calculation of revised EOQ. [7]

Given Data:

$$S = 300 \times 40$$

$$= 12,000 \text{ £-}$$

$$ch = 0.022 \times 300$$

$$= 6.6.$$

$$ch = cu \times i$$

$$= 6.6.$$

$$C_p = \text{Rs } 35/-$$

$$\therefore Q_0 = \sqrt{\frac{2 \cdot S \cdot C_p}{ch}}$$
$$= \sqrt{\frac{2 \times 12,000 \times 35}{6.6}}$$
$$= 356.75 \text{ No's.}$$

Ans:-

- 7] The annual consumption of spindles for gate valve by constⁿ material manufacturing company is 3000 No's. The unit cost of the spindle is Rs 20/- . The procurement & inventory carrying cost is Rs 100/- per order & 18/- respectively. The supplier has given following purchase plan.

Order Quantity	less than 500	500-1000	1000-1500	above 1500
Price	Rs 20/- per No	Rs 19/- No	Rs 18/- No	Rs 17/- No.

Suggest suitable purchase plan.

Given Data :-

$$S = \text{Annual Requirement (Units)} \\ = 3000 \text{ Nos.}$$

$$Cu = \text{Price or cost per unit} \\ = \text{Rs } 20/-$$

$$Cp = \text{Procurement cost per order} \\ = \text{Rs } 100/- \text{ per order.}$$

$$i = \text{Inventory carrying cost per annum.} \\ = 0.18.$$

$$Cu_1 = \text{Rs } 20/-$$

$$Cu_2 = \text{Rs } 19/-$$

$$Cu_3 = \text{Rs } 18/-$$

$$Cu_4 = \text{Rs } 17/-$$

Step I]

Price	Range of quantity	EOQ	Qty. to be purchased at indicated price
Rs 20/-	$0 < q < 500$	408.25	408.25

Rs 19/-	$500 < q < 1000$	418.85	500.00
Rs 18/-	$1000 < q < 1500$	430.35	1000.00
Rs 17/-	$1500 < q$	442.80	1500.00

Step II] Determine the quantity to be purchase at each price level which equals either EOQ or price break quantity.

Step III]

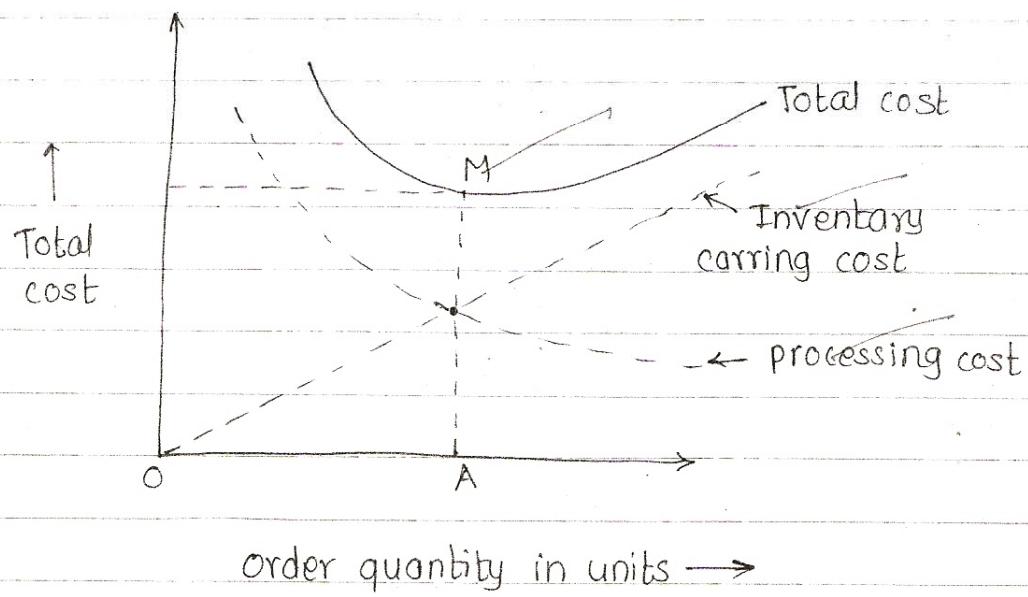
Cost Element	Price Discount			
	Rs 20/-	Rs 19/-	Rs 18/-	Rs 17/-
Order Quantity	408.25	500	1000	1500
1) Material cost = Cu.S	60,000	57,000	54,000	51,000
2) Procurement cost: S.CP / q	734.84	600	300	200
3) Annual inventory carrying cost $q/2 \cdot Cu.i$	736.84	855	1620	2295
ATC = ① + ② + ③	61,469.69	58,455	55,920	53,495

ep IV] Select an optimal purchase quantity from the annual total cost figure calculated above, we find the cost incurred is the least when the quantity purchased is 1500 No's

∴ Economic purchase quantity = 1500 No's.

Economical Order Quantity (EOQ):-

The material manager has to make better decisions regarding the complex problems about inventories & such decisions can be arrived at provided the problems are analysed & some scientific techniques is applied to approach the problem. If proper system is developed to analyse the various functions of inventory, keep up to date measurement of the proper level of stocks & control the sub-systems then it is always profitable to take quick decisions.



Economic order quantity is given by,

$$Q = \sqrt{\frac{2G.S}{C_u \cdot i}}$$

Q. Explain in detail techniques adopted for the inventory control in material management.

a) ABC analysis:-

ABC analysis classifies the items in A, B & C categories on the basis of their annual usage.

A items:

5-10% of the total items account for 70-75% of the total money spent on materials. These items require detailed & rigid control & need to be stocked in small quantities.

B items:-

10-15% of total items represents 10-15% of total expenditure on the materials. These are intermediate items.

C items:-

These are 70-80% of total items represents hardly 5-10% of total annual expenditure on materials & hence insignificant i.e. do not require close control.

b) HML analysis:-

In HML analysis, price criteria is used. The items are classified into three groups. - High, Medium, Low.

The analysis helps to -

- 1) Assess storage & security requirement.
- 2) keep control over consumption at the dept. level.
- 3) Determine the frequency of stock verification.
- 4) To evolve buying policies to control purchases.
- 5) To delegate authorities to different buyers of make petty cash purchases.

c) VED analysis:-

It classifies the items based on critically.

The items are classified into vital, essential & desirable.

1) Vital: It encompasses those items for want of which production would come to half.

2) Essential: It includes items whose stock out cost is very high.

3) Desirable: It consists of items which do not cause any immediate loss of production. The stock out of these items entail nominal expenditure & cause minor disruptions for a short duration.

It is the best suited for space inventory.

d) SDE analysis:-

It classifies the items into Scare, Difficult, & Easy.

1) Scare :

It includes the items which are in short supply, imported, or canalised through govt. agencies. Such items are best to produce once in year in lieu of effort & expenditure involved in the procedure for import.

2) Difficult:

It includes the items which are available indigenously but are not easy to produce. Items which from far off distance & for while reliable sources do not exist fall into this category.

3) Easy :

It covers those items which are readily available. Items produced to commercial standards, where supply exceeds demand & others which are locally available falls in this group.

e) XYZ analysis:-

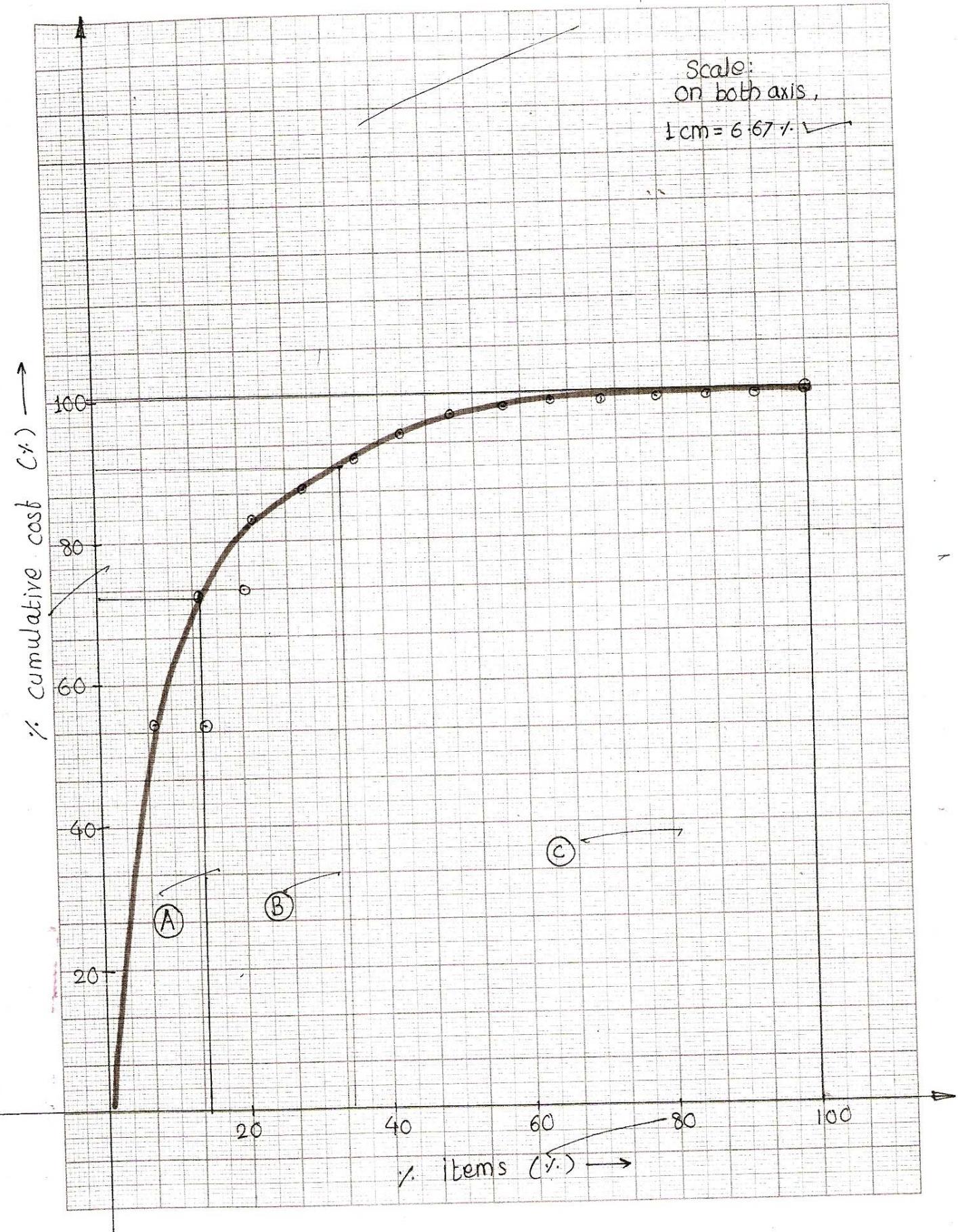
It is based on the value of the stocks on hand. i.e. inventory investment. Items whose inventory values are high called X items, those having low

values are called Z items & items having moderate inventory stocks are Y items.

- Q. carry out ABC analysis for the materials to be purchased as given below by the construction company. Present your answer graphically also.

Sr.No.	Description	Amount (RS)	sr.No.	Description	Amount (RS)
1	Mosaic Tiles	5180	8	C.A.	6800
2	Rubble soling	630	9	Neeru	550
3	Manglore tiles	7500	10	Brass handles	256
4	Steel Reinf.	6336	11	Stoppers for door	420
5	Sand	18074	12	Wash basin	600
6	cement	99750	13	Stop cock	600
7	Bricks	33600	14	Oil bond & distemper	1658

Sr. No.	Description	Amount (RS)	Cumu. cost (RS)	1. cumu. cost (%)	Item no.	1. item	Remark
1	Cement	99750	99,750	54.82	01	7.14	A
2	Bricks	33600	1,33,350	73.29	02	14.28	A
3	Sand	18074	1,51,424	83.22	03	21.43	B
4	Manglore tiles	7500	1,58,924	87.34	04	28.57	B
5	C.A.	6800	1,65,724	91.08	05	35.71	
6	Steel Reinf.	6336	1,72,060	94.56	06	42.86	
7	Mozaic Tiles	5180	1,77,240	97.41	07	50.00	
8	Oil bond, dist.	1658	1,78,898	98.32	08	57.14	
9	Rubble soling	630	1,79,528	98.67	09	64.29	C
10	Wash basin	600	1,80,128	98.99	10	71.43	
11	Stop cock	600	1,80,728	99.33	11	78.57	
12	Neeru	550	1,81,278	99.63	12	85.71	
13	Stopper for door	420	1,81,698	99.86	13	92.86	
14	Brass handles	256	1,81,954	100.00	14	100.00	



Graphically :

% Items	A	B	C
% cumulative cost	73.33	90.0	100
% Items	14.33	34.0	100

Jyothi
26/07/02

CONSTRUCTION MANAGEMENT

ASSIGNMENT NO. 03

PER. DATE: 22/07/2003
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