Inventory Models

Inventory

- **An idle resource of any kind provided such a resource has economic value.**

    By Fred Hansman

- Inventory as an idle resource is maintained to fulfill the present and future needs.

    Idle resources such as men, machines , materials or money.

    Def. - A physical resource that a firm holds in stock with the intent of selling it or transforming it into a more valuable state.

Why We Want to Hold Inventories

Reasons for carrying inventory:

- Improve customer service

- Reduce cost: Economies of production (run) and efficient and effective operation of the production system

- Maintenance of operational capability

- To meet irregular supply and demand

- Quantity discount

- To avoid stock outs (shortages)

Why We Do Not Want to Hold Inventories

Costs incurred in carrying inventory:

- Non-value added costs
- Opportunity cost
- Complacency
- Inventory deteriorates,

becomes obsolete,

lost, stolen, etc.

Inventory

Current trends in inventory management

Different forms of inventory

- Lot- size or cycle inventory.

- Pipeline inventory:(or Transit)

- Safety (or buffer) inventory: To take care of uncertainty

- Seasonal Inventory: to reduce the strain of peak demands

- Decoupling inventory: Interdependence of different processes

  - Raw Materials

  - Works-in-Process

  - Finished Goods

  - Maintenance, Repair and Operating (MRO)

Inventory cost components

- Purchase Cost:

- Carrying (holding) cost:

- Ordering (set-up):

- Shortage (stock out) and customer service cost:

Total Inventory Cost : Purchase cost + Ordering cost
                                    + Carrying cost + Shortage cost

Balancing Carrying against Ordering Costs

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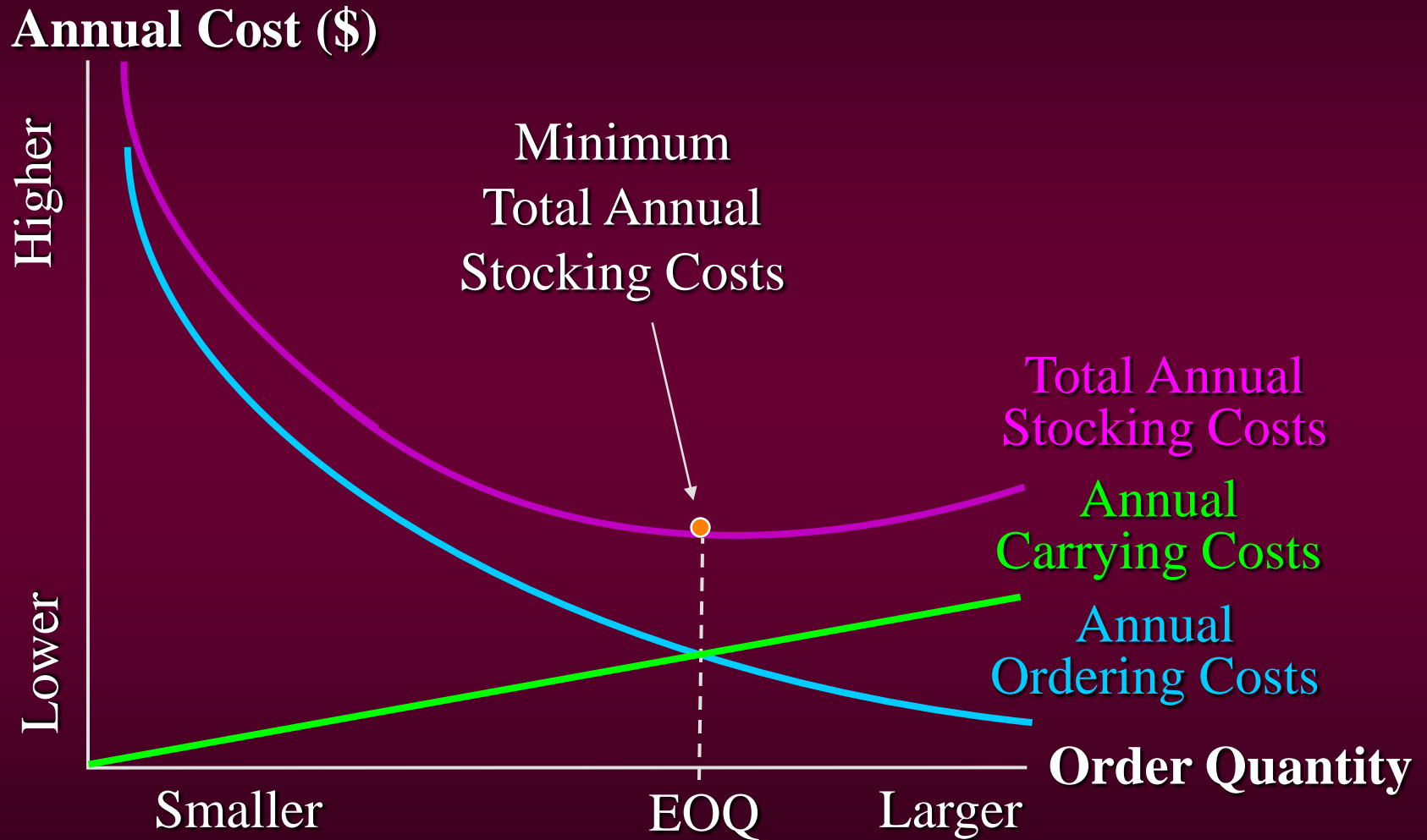
Important Definitions for Inventory System

1. Demand
2. Order Cycle
3. Lead time
4. Safety stock or buffer stock
5. Re-order quantity (ROQ)
6. Re-order level (ROL)
7. Demand during lead time

Fixed Order Quantity System (Q - system)

Order quantity is fixed and order placed when the stock level reaches a pre-determined re-order point

An application of this type system is the two-bin system

A perpetual inventory accounting system is usually associated with this type of system

Periodic Review System (P - system)

Orders are placed periodically at fixed intervals while ordering quantities can vary

Ss System : (Optional Replenishment)

Combines the features of P and Q systems

Selective Approaches to Inventory Control

Inventory Classification	Basis
❑ ABC	Usage value
❑ VED	Criticality of item
❑ HML	Unit cost
❑ SDE	Availability
❑ S-OS	Seasonality
❑ FSN	Speed of movement
❑ XYZ	Closing inventory value

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How much to be ordered

Order quantity usually depends upon:

a) Demand pattern

b) Price of an item, discount option and warehouse space, etc.

c) Lead time

Model I: Classical EOQ model

Assumptions: EOQ model with constant rate of Demand

- The inventory system involves one type of item

- The demand is known, continuous and constant

- The inventory is instantaneously replenished

- Lead time is constant and known

- Shortages are not allowed

- Purchase price and reorder costs do not vary with the quantity ordered

- Carrying cost and ordering cost per order are known and constant

Max Inventory level (Q)

Stock level

Order Quantity

Reorder Level (ROL)

Lead Time

t= Q/D

Time

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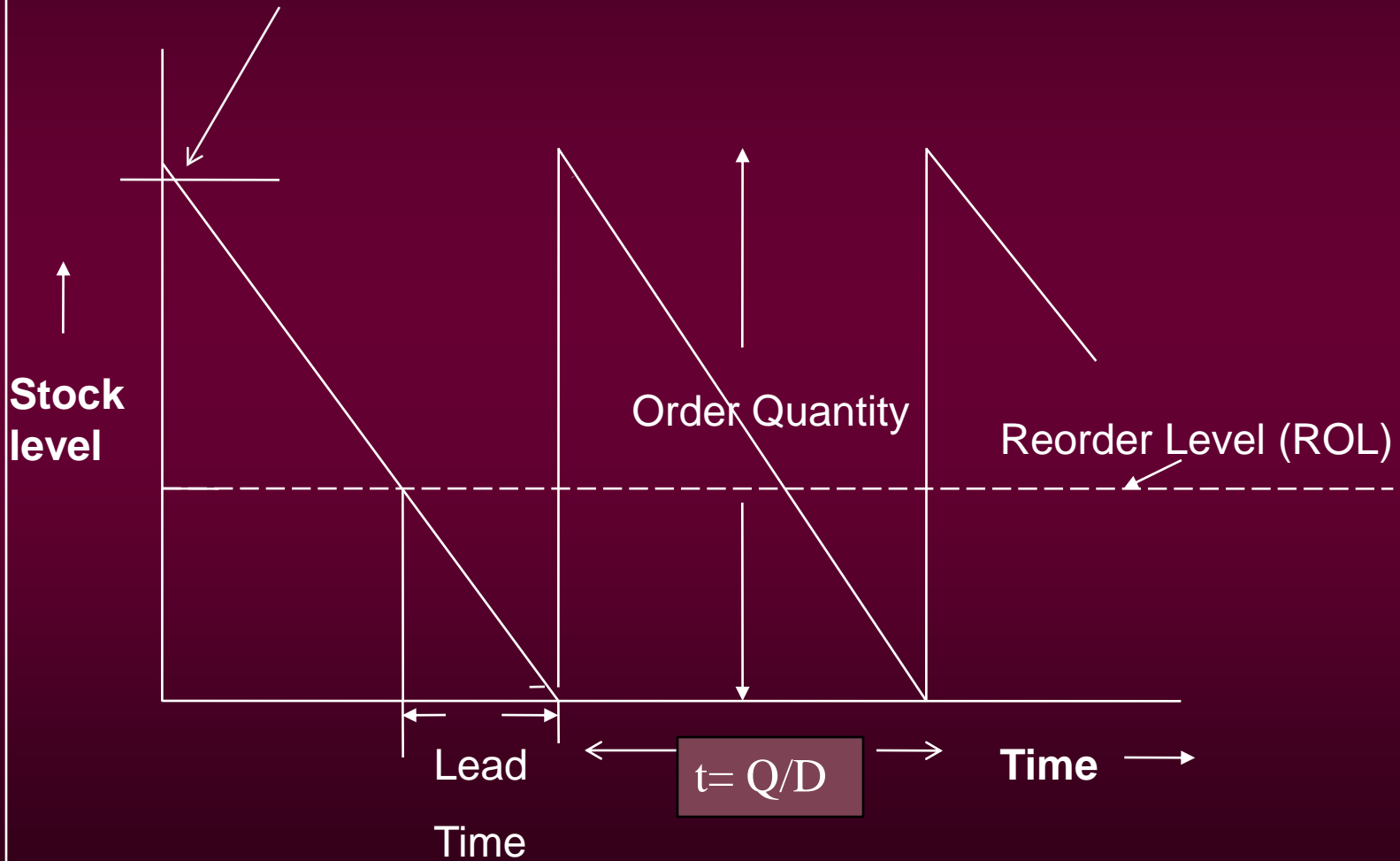
List of the notations :

D = Annual demand (requirement)of an item in Rs. per unit

Q = Order quantity ie. no. of units ordered per order

- C = Purchase cost (price) of an item in Rs. per unit

- C_o = Ordering cost (set-up) per order

- r = cost of carrying expressed in terms of % per unit time

- C_h = Cost of carrying one item per unit time (C x r)

- C_s = Shortage cost per unit per time

- n= no. of orders per time period

- t = inventory cycle time

Example 1:

❑ A company produces 2000 units of Tvsets in a year. It requires a equal no. of subpart for production which costs Rs. 10 and cost to hold it in stock for a year is Rs. 2.40. Cost of placing an order is Rs. 150.

Calculate EOQ, Annual total variable inventory cost, Inventory cycle, no. of orders and rupee value of EOQ.

Example : 2

- i)   Determine the EOQ and the total variable cost for the following

Annual demand	: 25 units
Unit Price	: Rs. 2.50
Order Cost	: Rs. 4.00
Storage rate	: 1% per year
Interest rate	: 12% per year
obsolescence rate	: 7% per year

ii) Compute the order quantity and the total variable cost that would result if an incorrect price of Rs. 1.60 were used for the item.

Assignment 1: Ex 1

- A company uses Rs. 15,000 worth of an item during the year. The ordering costs are Rs. 35 per order and carrying charges are 12.5% of the average inventory value. Find the economic order quantity, number of orders per year, time period per order and the total cost