CHAPTER 7
JUST-IN-TIME (JIT) INVENTORY MODELS UNDER FINANCIAL MANAGEMENT

7.1 INTRODUCTION:

As discussed earlier in Chapter 1, Ratio Analysis is a powerful tool for financial management. Under the usual approach, the turnover resulting from the raw materials and work-in-process is usually maintained low. But such a low turnover implies excessive inventory levels than that warranted by the production and sales activities, or a slow moving or obsolete inventory. However a relatively high turnover may be the result of a very low level of inventory which can result in frequent stockout situation.

The situation of stockouts is ruled out in a Just-in-Time (JIT) approach where necessary units are produced and supplied at necessary times in necessary quantities. Thus there are frequent deliveries in small shipments leading to minimum amounts of inventory thereby incurring a high turnover.

In contrast to the conventional analysis where a high turnover is an indicator of shortages, under JIT system, the firm is at an advantage in case of a high turnover. Since, the production on the shop floor is an on-going process, the finished goods are assembled on a just-in-time basis and hence there is no loss of goodwill.

In this chapter, the concept of inventory turnover ratio has been studied for various issues pertinent to the traditional inventory control techniques under a Just-in-Time (JIT) approach. The following models are studied in this chapter:

- **MODEL I**: Optimisation of inventory turnover ratio under a JIT system.
- **MODEL II**: Optimisation of inventory turnover ratio for a stock dependent demand under a JIT system.
- **MODEL III**: Optimisation of inventory turnover ratio for a multi-deterministic situation in JIT system.
- **MODEL IV**: Optimisation of inventory turnover ratio for a stock dependent demand in a multi-deterministic situation under a JIT approach.
Each model developed here is illustrated by means of numerical example for its illustration.

7.2 MODEL - 1: BASIC JUST-IN-TIME (JIT) MODEL WITH INVENTORY TURNOVER RATIO:

The concept of inventory turnovers is an important aspect of the Financial Analysis. The management of the firm whether good or bad is dependent on the turnovers.

The conventional theories state that a high turnover is an indicator of stockouts and a low turnover maintains too much of inventory which is obsolete. Thus, according to the usual practice, a good management is one that strikes a balance between high and low inventory turnovers.

The problem of shortages does not exist in case of a Just-in-Time (JIT) schedule. In this section, the basic model proposed by Ramasesh (1990) has been considered for the formulation of inventory turnovers under a JIT approach. Under the JIT system, frequent deliveries are made in small shipments, so that the overhead costs get reduced. Since frequent deliveries are made there is a long-term commitment between the vendor (supplier) and the buyer (manufacturer).

Here it is shown that a high turnover is extremely profitable to the firm in a JIT based situation. This theory is proved with the help of a hypothetical problem.

7.2.1 NOTATIONS:

The following notations are used in this model:

Q : Contract Quantity (units).

D : Annual Demand (units).

A : Cost of placing an order (Rs/order).

P : Aggregate cost per shipment.

N : Number of shipments per contract.

H : Inventory holding cost (Average inventory holding is $QH/2N$) (Rs/unit/shipment).
7.2.2 ASSUMPTIONS:

Model is derived under the following assumptions:

1. Annual demand is known and constant.
2. Shortages are not permitted.
3. Lead time is zero.
4. Rate of replenishment is instantaneous.

7.2.3 FORMULATION OF THE MODEL:

Considering the inventory model under the JIT approach proposed by Ramasesh (1990), the turnover ratio is defined as

\[ R(Q) = \frac{D}{\frac{D}{Q}(A + NP) + \frac{QH}{2N}} \]  
\[ = \frac{D}{H_1 \frac{D}{Q} + H_2 Q} \]  

where \( H_1 = (A + NP); H_2 = H/2N \). Differentiate equation (2) with respect to \( Q \) and equate it to zero. This gives

\[ \frac{dR(Q)}{dQ} = \frac{D}{H_1 \frac{D}{Q} + H_2 Q} \left[ H_1 \frac{D}{Q} + H_2 Q \right]^{-2} \left[ -H_1 \frac{D}{Q^2} + H_2 \right] = 0 \]  

which implies that

\[ Q^* = \sqrt{\frac{2ND(A + NP)}{H}} \]  

The turnover ratio is maximum only if the second derivative, \( \frac{d^2 R(Q)}{dQ^2} < 0 \). This implies that

\[ -D \left( -\frac{H_1}{Q^2} + H_2 \right) (-2) \left( H_1 \frac{1}{Q} + H_2 \right)^{-3} \left( -\frac{H_1}{Q^2} + H_2 \right) + \]
\[ (-D) \left( H_1 \frac{1}{Q} + H_2 \right)^{-2} \left( \frac{2H - 1}{Q^3} \right) < 0 \]  

i.e.

\[ (-H_1 + H_2 Q^2) - (H_1 + H_2 Q^2) H_1 < 0 \]  

Hence

\[ R(Q^*) = D/\sqrt{\frac{2DH(A + NP)}{N}} \]
7.2.4 HYPOTHETICAL ILLUSTRATION:

D: 2000 units.
A: Rs. 15/order.
P: Rs. 15.
N: 2
H: Rs.1.

Substituting these values in equation (4), we get $Q^* = 600$ For this value of $Q^*$ the optimal turnover ratio is $R(Q^*) = 6.70$

7.2.5 REMARKS:

For a given demand as contract quantity increases the total cost decreases in a JIT technique with the number of shipments. With the total cost reduction the turnover ratio also increases.

Under the traditional approach, as the contract quantity increases, the total cost increases thus decreasing the inventory turnover ratio.

This contrast between the traditional approach and that of JIT has been shown with the help of the numerical example. It is seen that the JIT system is more profitable than the usual approach.

7.3 MODEL - 2: OPTIMISATION OF INVENTORY TURNOVER RATIO FOR A STOCK DEPENDENT CONSUMPTION RATIO UNDER A JUST-IN-TIME (JIT) INVENTORY SYSTEM

7.3.1 INTRODUCTION:

The inventory turnovers are discussed here under a stock dependent consumption rate. The model proposed by Ramasesh (1990) is clubbed with the model by Gupta and Vrat (1983).
7.3.2 NOTATIONS:
The following notations are used in this model:

Q : Contract quantity (units).
D : Annual Demand (units).
A : Cost of placing an order (Rs/order).
P : Aggregate cost per shipment.
N : Number of shipments.
H : Inventory holding cost.

7.3.3 ASSUMPTIONS:
1. Demand is known and constant.
2. Shortages are not allowed.
3. Lead time is zero.
4. The rate of replenishment is instantaneous.

7.3.4 FORMULATION OF THE MODEL:
The inventory turnover ratio is given by:

\[ R(Q) = \frac{D}{\frac{D}{Q}(A + NP) + \frac{QH}{2N}} \] \hspace{1cm} (2.1)

Let us consider the following particular cases here.

7.3.5 CASE 1:
If \( D = \alpha + \beta Q^\gamma \ \alpha > 0, \ \beta > 0, \ 0 < \gamma < 1 \). Hence equation (2.1) can be written as:

\[ R(Q) = \frac{\alpha + \beta Q^\gamma}{\frac{\alpha + \beta Q^\gamma}{Q} H_1 + H_2 Q} \] \hspace{1cm} (2.2)
Therefore

\[ Q^* = \left( \frac{Q^{-\gamma}[\beta H_2(-\gamma - 1) + 2\alpha \beta H_1] - \alpha^2 H_1 - \beta^2 Q^{-2\gamma} H_1}{H_2[\beta (\gamma + 1) - \alpha]} \right)^{1/2} \]  

(2.10)

This equation can be solved by successive approximation. Here also the second derivative should be negative and it leads to give the usual sufficient condition.

The computer programs for above cases are given in Appendix 2.1 and Appendix 2.2 respectively.

7.3.7 HYPOTHETICAL ILLUSTRATION:

For the given values of \( Q = 10,000 \) units, \( A = \text{Rs.25/order} \), \( P = \text{Rs.25} \), \( N = 4 \), \( H = \text{Re 1/unit/order} \), \( \alpha = 100 \). The optimal values are as follows

<table>
<thead>
<tr>
<th>( \beta )</th>
<th>( \gamma )</th>
<th>( D = \alpha + \beta Q^\gamma )</th>
<th>( D = \alpha - \beta Q^{-\gamma} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \beta )</td>
<td>( \gamma )</td>
<td>( Q^* )</td>
<td>( K(Q^*) )</td>
</tr>
<tr>
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<td>0.1</td>
<td>320.420</td>
<td>1.276</td>
</tr>
<tr>
<td>3</td>
<td>0.1</td>
<td>328.755</td>
<td>1.298</td>
</tr>
<tr>
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<td>0.1</td>
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<tr>
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<td>0.3</td>
<td>333.126</td>
<td>1.300</td>
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<td>0.3</td>
<td>368.222</td>
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<tr>
<td>5</td>
<td>0.3</td>
<td>404.964</td>
<td>1.434</td>
</tr>
<tr>
<td>1</td>
<td>0.5</td>
<td>376.660</td>
<td>1.377</td>
</tr>
<tr>
<td>3</td>
<td>0.5</td>
<td>530.837</td>
<td>1.593</td>
</tr>
<tr>
<td>5</td>
<td>0.5</td>
<td>736.051</td>
<td>1.785</td>
</tr>
</tbody>
</table>

7.3.8 REMARKS:

The inventory turnover is maximised under a Just-in-Time approach. Usually a high turnover ratio is an indication of stockouts. But in a JIT system the production is continuous. Hence the units are never out of stock. Two different cases of demand are considered here. From the hypothetical problem, it is evident that for a constant \( \gamma \) and \( \beta \) varying, the value of \( Q^* \) increases in both the cases. The turnover ratios are in increasing order.
7.4 MODEL - 3: OPTIMISATION OF INVENTORY TURNOVER RATIO IN A MULTI-DETERMINISTIC SITUATION UNDER A JUST-IN-TIME (JIT) APPROACH

7.4.1 INTRODUCTION:

When the inventories consist of several items under some limitations, it may not be possible to consider each item separately, since there exists a relationship between them. Then the technique of Lagrangian multipliers is used to tackle such cases.

The extensive literature on O.R. reveals that such issues are discussed under the aspect of Inventory Management. Here, this problem has been merged with the turnover ratio under a Just-in-Time (JIT) schedule.

When a restriction is imposed on the maximum amount to be invested on inventories, the excess of money that is spent on the idle resources is reduced. Due to this, the amount of inventory stocked is in turn reduced to a minimum.

In a Just-in-Time (JIT) technique the inventories are reduced to a minimum, thus reducing the cost incurred due to inventories. Usually a low turnover ratio indicates more stocks being retained whereas a high turnover indicates often stockouts. Thus, a balance between a high turnover and a low turnover is considered to establish good management control.

In contrast to this under a JIT system a high turnover is considered to be beneficial to the firm. Since, the assembly-line production is an on-going process, the units are manufactured and supplied as and when required. This reduces the bulk of inventory and the amount spent on inventories. Shortages are not permitted in a JIT system leading to a high-turnover ratio.

Here the turnover ratio has been considered under a multi-deterministic situation for a JIT based system and there is a limit on the amount that can be incurred on inventories. The results obtained are justified with the help of a hypothetical example.

7.4.2 NOTATIONS:

The following notations are used in this model:

Q: Lot size (units)

D: Annual Demand (units).
A : Cost of placing an order (Rs/order).

P : Aggregate cost per shipment.

N : Number of shipments.

H : Inventory holding cost.

7.4.3 ASSUMPTIONS:

Model is derived under the following assumptions:

1. Demand is known and uniform.

2. Shortages are not permitted.

3. Lead time is zero.

4. Production or supply of commodity is instantaneous.

5. There is a limit imposed on inventories.

7.4.4 FORMULATION OF THE MODEL:

The turnover ratio is defined as

\[ R(Q) = \frac{D}{\frac{P}{Q}(A + NP) + \frac{QH}{2N}}. \]  

(3.1)

When the inventories consist of several items, the total cost is given by

\[ \text{Total cost} = \sum_{i=1}^{n} \left[ (A_i + N_i P_i) \frac{D_i}{Q_i} + \frac{Q_i H_i}{2N_i} \right]. \]  

(3.2)

Since, there is a limitation on inventories, the objective is to minimise the total variable cost subject to the condition that \( \sum_{i=1}^{n} Q_i \leq K \) where \( K \) is the maximum limit on inventories. Thus, for determining the optimum value of \( Q \) that minimises the overall cost and thereby maximises inventory, the Lagrangian function is defined as follows

\[ L = \sum_{i=1}^{n} \left[ (A_i + N_i P_i) \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum_{i=1}^{n} Q_i - K \right] \]  

(3.3)
where $\lambda$ is a Lagrangian multiplier. The turnover under a multi-deterministic situation is formulated as

$$R(Q) = \frac{D}{\sum_{i=1}^{n} \left[ (A_i + N_i P_i) \frac{D_i}{Q_i} + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum_{i=1}^{n} Q_i - K \right]}$$

(3.4)

where $Q = \sum_{i=1}^{n} Q_i$. Differentiating eqn. (3.4) w.r.t. ‘$Q_i$’ and equating it to zero, we optimise $R(Q)$

$$\frac{\partial R(Q)}{\partial Q_i} = 0$$

which implies that

$$D \cdot \frac{\partial}{\partial Q_i} \left[ \sum_{i=1}^{n} (A_i + N_i P_i) \frac{D_i}{Q_i} + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum_{i=1}^{n} Q_i - K \right] = 0.$$  

(3.5)

which implies that

$$D \left\{ - \frac{D_i}{Q_i^2} (A_i + N_i P_i) + \frac{H_i}{2N_i} + \lambda \right\} = 0$$

(3.6)

i.e.

$$\frac{D_i}{Q_i^2} (A_i + N_i P_i) = \lambda + \frac{H_i}{2N_i}$$

(3.7)

Therefore

$$Q_i^* = \sqrt{\frac{2N_i D_i (A_i + N_i P_i)}{2\lambda N_i + H_i}}$$

(3.8)

which minimises total cost given in (3.2) above.

7.4.5 HYPOTHETICAL ILLUSTRATION:

There are four items for which the various inventory costs are as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Holding cost</th>
<th>Ordering cost</th>
<th>Demand</th>
<th>Cost per $i^{th}$ unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>20</td>
<td>12,000</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>0.50</td>
<td>25</td>
<td>15,000</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>1.50</td>
<td>27</td>
<td>20,000</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>2.00</td>
<td>30</td>
<td>25,000</td>
<td>4</td>
</tr>
</tbody>
</table>

$N =$ Number of shipments $= 4$.

It is given that the maximum amount available should not exceed Rs.8000/-.

$$Q_1^* = 399.411 \text{ units} \approx 399 \text{ units.}$$

$$Q_2^* = 5447.225 \text{ units} \approx 5447 \text{ units.}$$
\[ Q_2^* = 3680.580 \text{ units} \sim 3681 \text{ units}. \]
\[ Q_4^* = 3605.551 \text{ units} \sim 3606 \text{ units}. \]

Amount spent on average inventory is given by

\[
\frac{399}{2} \times 6 + \frac{5447}{2} \times 7 + \frac{3681}{2} \times 5 + \frac{3606}{2} \times 4 = \text{Rs.}36676.
\]

This amount is greater than the available amount of Rs.8,000/-.

In this case for \( \lambda = 2 \),
\[ Q_1^* = 590.839, \quad Q_2^* = 679.366, \quad Q_3^* = 778.824, \quad Q_4^* = 874.475. \]

The cost of average inventory is 7846.308 which does not exceed Rs.8000.

7.4.6 REMARKS:

Usually the inventory consists of many items. Hence it is not possible to consider each item separately. We can impose a limit on the maximum amount that can be invested on inventories so that the turnover ratio for the firm can be maximised.

From the hypothetical problem it can be observed that the cost of average inventory is Rs.7846.308 which is less than the maximum limit of Rs.8000. This means that under the JIT approach, the amount of average inventory is much less than the imposed limit. Hence the additional amount can be spent on some other resource utilization.

In contrast to this under the traditional inventory control there is no amount left out from the limit that is imposed on the inventories. Hence the cost incurred due to inventories is more as compared to that in a Just-in-Time (JIT) based inventory system.

7.5 MODEL - 4 : OPTIMISATION OF INVENTORY TURNOVER RATIO FOR A STOCK DEPENDENT DEMAND IN A MULTI-DETERMINISTIC SITUATION UNDER A JUST-IN-TIME (JIT) APPROACH

7.5.1 INTRODUCTION:

In the model discussed in the previous section, the demand is considered to be uniform and constant. Here the demand is not constant but it is assumed to be stock dependent.
The turnover is maximised for a stock dependent consumption rate in a multi-
deterministic situation where a limit has been imposed on the amount invested on
inventories.

The results obtained are justified with the help of a hypothetical illustration.

7.5.2 NOTATIONS:
The following notations are used in this model:

Q : Lot size (units)
D : Annual Demand (units).
A : Cost of placing an order (Rs/order).
P : Aggregate cost per shipment.
N : Number of shipments.
H : Inventory holding cost.

7.5.3 ASSUMPTIONS:
Model is derived under the following assumptions:

1. Demand is stock dependent.
2. Shortages are not permitted.
3. Lead time is zero.
4. Production or supply of commodity is instantaneous.
5. There is a limit imposed on inventories.

7.5.4 FORMULATION OF THE MODEL:
As discussed earlier, the turnover ratio is defined as :

\[ R(Q) = \frac{D}{Q(A + NP) + \frac{QH}{2N}} \]  
(4.1)
When the inventories consist of several items, the total cost is given by:

\[ TC(Q) = \sum_{i=1}^{n} \left[ (A_i + N_i P_i) \frac{D_i}{Q_i} + \frac{Q_i H_i}{2N_i} \right] \]  

(4.2)

There is a limitation on inventories, the objective is to minimise the total cost subject to the condition that \( \sum Q_i \leq K \) where \( K \) is the maximum limit on inventories. Thus the Lagrangian function is defined as

\[ L = \sum_{i=1}^{n} \left[ (A_i + N_i P_i) \frac{D_i}{Q_i} + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum Q_i - K \right] \]  

(4.3)

where \( \lambda \) is a Lagrangian multiplier. Thus the turnover ratio for different stock-dependent demand functions can be defined as under

7.5.5 CASE 1:

When \( D = \alpha + \beta Q^\gamma \) where \( \alpha, \beta, \gamma \) are constants. Here

\[ R(Q) = \frac{\alpha + \beta Q_i^\gamma}{\sum_{i=1}^{n} \left( \frac{\alpha + \beta Q_i^\gamma}{Q_i} \right) (A_i + N_i P_i) + \frac{Q_i H_i}{2N_i} + \lambda \left[ \sum Q_i - K \right]} \]  

(4.4)

Differentiating eqn. (4.4) w.r.t. ‘\( Q_i \)’ and equating it to zero, we get the optimal value of \( Q_i \). Hence

\[ \frac{\partial R(Q)}{\partial Q_i} = 0 \] gives

\[ \sum_{i=1}^{n} \left[ \frac{\alpha + \beta Q_i^\gamma}{Q_i} (A_i + N_i P_i) + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum_{i=1}^{n} Q_i - K \right] (\beta \gamma Q_i^{\gamma-1}) \]

\[ -\left( \alpha + \beta Q_i^\gamma \right) \left[ \left( \frac{-\alpha}{Q_i^2} + (\gamma - 1)\beta Q_i^{\gamma-2} \right) (A_i + N_i P_i) + \frac{H_i}{2N_i} + \lambda \right] = 0 \]  

(4.5)

which implies that

\[ \sum_{i=1}^{n} \left[ 2N_i (A_i + N_i P_i) (\alpha + \beta Q_i^\gamma) + Q_i H_i \right] (\beta \gamma Q_i^{\gamma-1}) + \lambda \left( \sum_{i=1}^{n} Q_i - K \right) - \]

\[ \left( \alpha + \beta Q_i^\gamma \right) \left[ \left( \frac{-\alpha}{Q_i^2} + (\gamma - 1)\beta Q_i^{\gamma-2} \right) (A_i + N_i P_i) + \frac{H_i}{2N_i} + \lambda \right] = 0 \]  

(4.6)

so that

\[ \sum_{i=1}^{n} \left[ 2N_i (A_i + N_i P_i) (\alpha \beta \gamma Q_i^{\gamma-1} + \beta^2 Q_i^\gamma) + \beta Y Q_i^{\gamma+1} H_i \right] + \lambda \left[ \sum_{i=1}^{n} Q_i - K \right] \]
- \left[ \frac{(-\alpha^2 + \alpha\beta YQ_i - \alpha\beta Q^2_i + \beta^2\gamma Q^2_1 - \beta^3 Q^3_1)}{Q_i^2} \right] (A_i + N_ip_i) + 
abla \frac{H_i}{2N_i} = 0. \quad (4.7)

Solving this equation we obtain

\[ Q_i^* = \left[ \frac{H_i}{2N_i}(-1 - Q) + \lambda(K - \sum_{i=1}^{n} Q_i) \right]^{1/\gamma} \quad (4.8) \]

This equation can be solved by successive approximation.

### 7.5.6 CASE 2:

When \( D = \alpha - \beta Q^{-\gamma} \), where \( \alpha, \beta, \gamma \) are constants. Here

\[ R(Q) = \sum_{i=1}^{n} \left[ \frac{\alpha - \beta Q_i^{-\gamma}}{Q_i} (A_i + N_iP_i) + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum Q_i - K \right] \quad (4.9) \]

Differentiating equation (4.9) w.r.t. ‘\( Q_i \)’ and equating to zero, we get optimal value of \( Q_i \)

\[ \frac{\partial R(Q)}{\partial Q_i} = 0 \]

\[ \sum_{i=1}^{n} \left[ \frac{\alpha - \beta Q_i^{-\gamma}}{Q_i^2} (A_i + N_iP_i) + \frac{Q_i H_i}{2N_i} \right] + \lambda \left[ \sum Q_i - K \right] \left( \beta \gamma Q_i^{-\gamma-1} \right) = 0 \quad (4.91) \]

which implies that

\[ \sum_{i=1}^{n} \left[ 2N_i(A_i + N_iP_i)(\alpha - \beta Q_i^{-\gamma}) + Q_i^2 \frac{H_i}{2N_i} \right] \left( \beta \gamma Q_i^{-\gamma-1} \right) + \lambda \left( \sum_{i=1}^{n} Q_i - K \right) \]

\[ \left( -\frac{\alpha + (-\gamma - 1) \beta Q_i^{-\gamma-2}}{Q_i^2} \right) (A_i + N_iP_i) + \frac{H_i}{2N_i} + \lambda \] = 0 \quad (4.92)

Solving this equation we obtain

\[ Q_i^* = \left[ \frac{H_i}{2N_i}(+1 + Q) + \lambda(K - \sum Q_i) \right]^{1/\gamma} \quad (4.93) \]

This equation cannot be solved explicitly. Hence we use successive approximation method to find the solution.
### Hypothetical Illustration:

<table>
<thead>
<tr>
<th>Item</th>
<th>Holding cost</th>
<th>Ordering cost</th>
<th>Contract Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Re.1.00</td>
<td>Rs.20</td>
<td>10,000</td>
</tr>
<tr>
<td>2</td>
<td>Rs.1.25</td>
<td>Rs.22</td>
<td>12,000</td>
</tr>
<tr>
<td>3</td>
<td>Rs.1.50</td>
<td>Rs.25</td>
<td>15,000</td>
</tr>
</tbody>
</table>

The maximum limit to be spent on inventories is Rs.75000.

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\gamma$</th>
<th>$Q^*$</th>
<th>$R(Q^*)$</th>
<th>Case I</th>
<th>$Q^*$</th>
<th>$R(Q^*)$</th>
<th>Case II</th>
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<td>180</td>
<td>7.0</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>174</td>
<td>8.0</td>
<td></td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td>3</td>
<td>0.3</td>
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<td>11.00</td>
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<td>8.2</td>
<td></td>
<td></td>
</tr>
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### 7.5.8 REMARKS:

The turnover ratio is maximised under a Just-in-Time (JIT) schedule. There are many items that a firm is producing at a time. Hence it is not possible to consider them separately and therefore, a multi-deterministic situation is to be considered.

From the hypothetical illustration it is evident that for fixed \( \beta \) and varying \( \gamma \)
and fixed contract quantity, there is a gradual increase in the turnover ratio, in the case of a positive relationship between demand and lot-size.

In case of a negative relationship between demand and lot size, for fixed $\beta$ and varying $\gamma$ there is again a gradual increase in the turnover ratio, for a fixed contract quantity.

But, this turnover is less than that in case of a positive relationship. Overall view predicts that a high turnover is beneficial to the firm on a Just-in-Time (JIT) basis because shortages are not permitted.

7.6 CONCLUSIONS:

In this chapter, various cases of inventory control have been considered for Financial Analysis under the Just-in-Time (JIT) schedule.

Financial Analysis reveals that the concept of turnover plays a very important role in the overall performance of the firm. A low or high turnover may be an indication of poor management. A low turnover implies too much of inventory being held as obsolete and a high turnover implies incurring shortages thereby losing the goodwill of the customers. Thus usually a balance is struck between these two types of situations.

In this Chapter the problem of turnovers has been considered under the JIT schedule wherein the units are produced and supplied just-in-time and thereby eliminating waste. Using this analogy the ideal situation of JIT production and supply is undertaken. In the various models studied in this chapter, it is unanimously proved that a high turnover is extremely profitable to the firm under the JIT scheme because shortages are not permitted. Hence an overall review of the different models that are formulated reveal that high turnover is an indication of good management leading to the better performance of the firm.