PAPER – 17 - STRATEGIC PERFORMANCE MANAGEMENT

The following table lists the learning objectives and the verbs that appear in the syllabus learning aims and examination questions:

	Learning objectives	Verbs used	Definition
LEVEL C	KNOWLEDGE What you are expected to know	List	Make a list of
		State	Express, fully or clearly, the details/facts
		Define	Give the exact meaning of
	COMPREHENSION What you are expected to understand	Describe	Communicate the key features of
		Distinguish	Highlight the differences between
		Explain	Make clear or intelligible/ state the meaning or purpose of
		Identity	Recognize, establish or select after consideration
		Illustrate	Use an example to describe or explain something
	APPLICATION How you are expected to apply your knowledge	Apply	Put to practical use
		Calculate	Ascertain or reckon mathematically
		Demonstrate	Prove with certainty or exhibit by practical means
		Prepare	Make or get ready for use
		Reconcile	Make or prove consistent/ compatible
		Solve	Find an answer to
		Tabulate	Arrange in a table
	ANALYSIS How you are expected to analyse the detail of what you have learned	Analyse	Examine in detail the structure of
		Categorise	Place into a defined class or division
		Compare and contrast	Show the similarities and/or differences between
		Construct	Build up or compile
		Prioritise	Place in order of priority or sequence for action
		Produce	Create or bring into existence
	SYNTHESIS How you are expected to utilize the information gathered to reach an optimum conclusion by a process of reasoning	Discuss	Examine in detail by argument
		Interpret	Translate into intelligible or familiar terms
		Decide	To solve or conclude
	EVALUATION How you are expected to use your learning to evaluate, make decisions or recommendations	Advise	Counsel, inform or notify
		Evaluate	Appraise or asses the value of
		Recommend	Propose a course of action

Paper – 17 - Strategic Performance Management

Full Marks: 100 **Time Allowed: 3 hours**

This paper contains 10 questions, divided in three sections Section A, Section B and Section C. In total 7 questions are to be answered.
From Section A, Question No.1 is compulsory and answer any two questions from Section A (out of three questions - Questions Nos. 2 to 4). From Section B, Answer any two questions (i.e. out of Question nos. 5 to 7). From Section C, Answer any two questions (i.e. out of Question nos. 8 to 10).

Students are requested to read the instructions against each individual question also . All workings must form part of your answer. Assumptions, if any, must be clearly indicated.

Section –A

[Question 1 is compulsory and answer any 2 from the rest]

1. **Read the following case study and answer the following questions:**

Whirlpool Corporation is a leader of the $100 billion global home appliance industry. Ranked sixth in the electronics industry list of FORTUNE magazine's "World's Most Admired Companies", Whirlpool Corporation is a Fortune 500 company and the world's leading manufacturer and Marketer of major home appliances. Annual sales are approximately $19 billion, and there are 70,000 employees, with 69 manufacturing and technology research centers around the world.

Founded in 1911, the company markets Whirlpool, Maytag, Kitchen Aid, Jenn-Air, Amana, Brastemp, Consul, Bauknecht and other major brand names to consumers in most countries around the world. Whirlpool manufactures appliances across all major categories, including fabric care, cooking, refrigeration, dishwashers, countertop appliances, garage organization and water filtration. Whirlpool is committed to a brand value-creation strategy—focusing on innovation, cost Productivity, product quality and consumer value. The company continues to improve its global Operating platform to ensure it is the best-cost and best-quality appliance manufacturer Worldwide. Its supply chain has been transformed to better deliver products to trade customers and consumers. The benefits of actions are evident through a stronger network, increased efficiencies and timely deliveries. Whirlpool Corporation is committed to building products which consumers around the world can depend upon to meet their daily needs. This commitment to quality begins in the concept stages and continues throughout the lifetime of the appliance. The result of these efforts is a sustainable and competitive advantage for the company.

Globally, Whirlpool Corporation manufactures products using principles of lean manufacturing and operational excellence to ensure continuous improvement of processes and to produce products that meet the company's high-quality standards. At Whirlpool, there is a constant focus on seeking out new and unique ways to improve the function, performance and Sustainability of products.

After acquiring the Maytag Corporation on March 31, 2006, Whirlpool Corporation became the largest home appliance maker in the world.

A merger with Maytag added another layer of complexity to Whirlpool's efforts to manage sales, orders, and cash flow. Brian Hancock, VP Supply Chain, talks about how this was achieved. Until recently, Whirlpool's strategic focus was on its products and brands. In recognition of environmental changes (customer needs in particular) attention was shifted to their supply chain and how best to manage it. The need to focus on the supply chain was also instigated by major internal and organizational changes (the merger with Maytag). Furthermore it was recognized that two issues required attention: 1) the desire for

trade partners to hold lots of inventory (which impacted upon cash flows) 2) balancing number one with customers needing their products quickly. One of the goals constraining the redesign of their supply chain was to ensure a customer order could be fulfilled and delivered to the customer within 48hrs. The company set about its operations/ supply chain strategy with the aim of improving cash flow, reducing costs and providing the right service to customers.

The first aspect of their strategy was the order process. Process, technology and inventory changes were made. Systems required replacement and integration with Maytag systems. Overall, there was a need to improve visibility within the supply chain.

Secondly, the company rationalized facilities, reducing the number of buildings from 184; they eliminated 100 buildings and consolidated major warehouses into 10 regional distribution centers. This resulted in cost savings of over $60 Million.

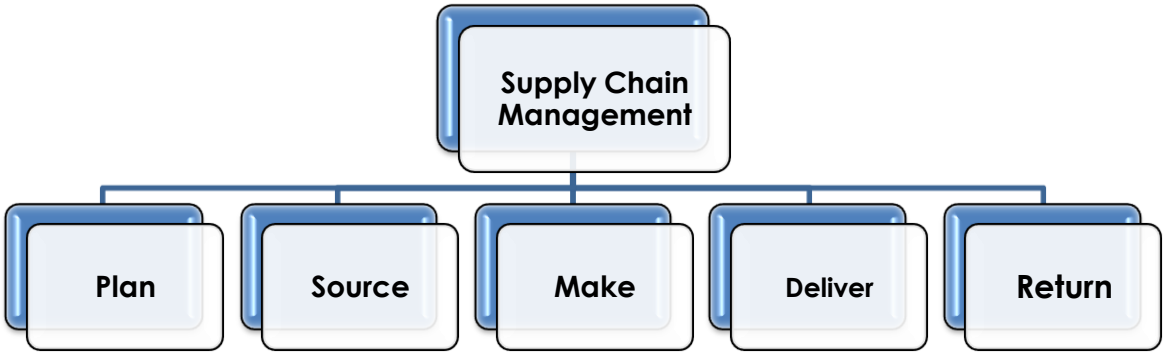
Thirdly, they optimized supply and demand, with changes to demand planning models and Software and integration with upstream suppliers.

Required:

(a) Describe Components of Supply Chain Management.
(b) Describe the objectives of the Supply chain Management.
(c) Importance of Supply Chain Management.
(d) Describe the challenges faced by the company: What were the drivers for change to the supply chain?
(e) Describe the Whirlpool strategy. **[5+3+3+5+4 = 20]**

Answer of 1:

(a) There are five basic components of Supply Chain Management. These are showing in the diagram:



(i) Plan: This is the strategic portion of SCM. You need a strategy for managing all the resources that go toward the meeting customer demand for your product and services.

(ii) Source: Choose the suppliers that will deliver the goods and services you need to create your product. Develop a set of pricing, delivery and payment processes with suppliers and create metrics for monitoring and improving the relationships.

(iii) Make: This is the manufacturing step. Schedule the activities necessary for production, testing, packaging and preparation for delivery.

(iv) Deliver: This is the part that many insiders refer to as logistics. 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.

(v) Return: The problem part of the supply chain. Create a network for receiving defective and excess products back from customers and supporting customers who have problems with delivered products.

(b) Objective of Supply Chain Management:

(i) Supply Chain Management takes into consideration every facility that has an impact on cost and plays a role in making the product conform to customer requirements: from supplier and manufacturing facilities through warehouses and distribution centers to retailers and stores.

(ii) The Supply Chain Management is to be efficient and cost effective across the entire system; total system wide costs from transportation and distribution to inventories of raw materials, work – in-progress and finished goods are to be minimized.

(iii) Finally, Supply Chain Management revolves around efficient integration of suppliers, manufacturers, warehouses and stores; it encompasses the firm's activities at many levels, from the strategic level through the tactical to the operational level.

(c) In the ancient Greek fable about the tortoise and the hare, the speedy and overconfident rabbit fell asleep on the job, while the "slow and steady" turtle won the race. But in today's demanding business environment, "slow and steady" won't get you out of the starting gate, let alone win any races. Managers these days recognize that getting products to customers faster than the competition will improve a company's competitive position. To remain competitive, companies must seek new solutions to introduce Supply Chain Management issues. Companies must face corporate challenges that impact Supply Chain Management such as reengineering, globalization and outsourcing.

Why is it so important for companies to get products to their customers quickly? Faster product availability is key to increasing sales, says R. Michael Donovan of Natick, Mass., a management consultant specializing in manufacturing and information systems. "There's a substantial profit advantage for the extra time that you are in the market and your competitor is not," he says. "If you can be there first, you are likely to get more orders and more market share." The ability to deliver a product faster also can make or break a sale. "If two alternatives products appear to be equal and one is immediately available and the other will be available in a week, which would you choose? Clearly, **"Supply Chain Management has an important role to play in moving goods more quickly to their destination."**

(d) Until recently, Whirlpool's strategic focus was on its products and brands. In recognition of environmental changes (customer needs in particular) attention was shifted to their supply chain and how best to manage it. The need to focus on the supply chain was also instigated by major internal and organizational changes (the merger with Maytag). Furthermore it was recognized that two issues required attention: 1) the desire for trade partners to hold lots of inventory (which impacted upon cash flows) 2) balancing number one with customers needing their products quickly. One of the goals constraining the redesign of their supply chain was to ensure a customer order could be fulfilled and delivered to the customer within 48hrs. The company set about its operations/ supply chain strategy with the aim of improving cash flow, reducing costs and providing the right service to customers. A merger with Maytag added another layer of complexity to Whirlpool's efforts to manage sales, orders, and cash flow. Brian Hancock, VP Supply Chain, talks about how this was achieved.

(e) The first aspect of Whirlpool's strategy was the order process. Process, technology and inventory changes were made. Systems required replacement and integration with Maytag systems. Overall, there was a need to improve visibility within the supply chain.

Secondly, the company rationalized facilities, reducing the number of buildings from 184; they eliminated 100 buildings and consolidated major warehouses into 10 regional distribution centers. This resulted in cost savings of over $60 Million.

Thirdly, they optimized supply and demand with changes to demand planning models and Software and integration with upstream suppliers.

2.(a) Division A is a profit centre that produces three products X, Y and Z and each product has an external market.

The relevant data is as:

Particulars	X	Y	Z
External market price per unit (₹)	48	46	40
Variable cost of production (Division A) (₹)	33	24	28
Labour hours per unit (Division A)	3	4	2
Maximum external sales units	800	500	300

Up to 300 units of Y can be transferred to an internal Division B.

Division B has also the option of purchasing externally at a price of ₹ 45 per unit. Determine the transfer price for Y. The total labour hours available in division A is:

(i) 3,800 hours

(ii) 5,600 hours

(b) Discuss the role of the Management Accountant in value chain Analysis.

(c) State the steps of Business Process Re – Engineering. [12+4+4]

Answer of 2:

(a) Labour hours requirement to meet potential external demand =
800 × 3 + 500 x 4 + 300 × 2 = 5000 hours

Contribution per unit

Sl No.	Particulars	x	Y	Z
a.	Selling price per unit (₹)	48	46	40
b.	Variable cost per unit (₹)	33	24	28
c.	Contribution per unit (a - b)	15	22	12
d.	Labour hours per unit	3	4	2
e.	Contribution per labour hour (₹) (c / d)	5	5.50	6
	Ranking	III	II	I

(i) When labour hour is limited to 3800 hours

First 300 units of Z @ 2 hours = 600 hours

Second 500 units of Y @ 4 hours = 2000 hours

* Third 400 units of X @ 3 hours = 1200 hours

* *This is determined from the balance hours*

If 300 units of Y has to be transferred to division B then an additional 300 units of Y will have to be produced using 300 x 4 = 1200 hours. Thus no production X will be possible. Transfer price = variable cost of Y = ₹ 24

Since Division A is working at full capacity then there will be an opportunity loss from not being able to meet all the demand.

Opportunity loss = contribution foregone by not producing X = 4 hours x ₹ 5 per hour = ₹ 20.

Since the transfer price should be = ₹ 24 + ₹ 20 = ₹ 44.

(ii) When labour hour is limited to 5600 hours

The maximum time required to all external demand
= 3800 hours as calculated above + 400 x 3 (for the extra A)
5000 hours, leaving a balance of 600 hours to meet internal demand of Y.
With the surplus 600 hours 600/4 = 150 units of Y can be produced within available capacity. The transfer price for this will be just the variable cost @ ₹ 24 per unit. Thus total cost for 150 units is ₹ 3600.
To produce balance of 150 units of Y for internal consumption 600 labour hours will have to be released by curtailing of production of X. And contribution forgone on X = 600 x 5 = ₹ 3000.
Thus the total price for 300 units of Y internal demand
= variable cost of 300 units of Y + Opportunity loss of ₹ 3000 = 10,200
Transfer price per unit = 10200/300 = ₹ 34.

(b) Role of the Management Accountant in VCA.

The Management Accountant's role will be scant in the following areas-

(i) **Need for education, training and awareness:**
Management Accountants should bring the importance of customer value to the forefront of Management's strategic thinking. They should take the initiative to bring the Value Chain message to major players in the Firm through seminars, articles, Value Chain examples and Company- specific applications.

(ii) **Exploring for information:**
VCA requires expertise in internal operations and information and also remands a great deal of external information. Management Accountants must seek relevant financial and non-financial information from sources outside the Firm.

(iii) **Creativity:**
Management Accountants must integrate databases and potential sources of timely information on competitive forces confronting the business. This calls for innovation and creativity in gathering and analyzing information for management decisions.

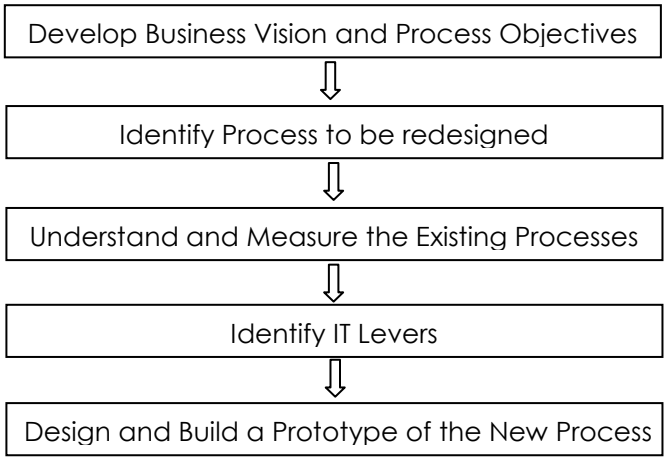
(iv) **System design:**
Designing internal and external information systems to assist managers in planning, monitoring and improving value-creating processes is another challenge of Management Accountants.

(v) **Co-operation:**
Management Accountants should solicit support from all senior managers for allocating resources to develop and improve Value Chain-oriented Information Systems. The Management Accountant should ensure that the Top Management is committed to Value Chain Analysis and the organizational changes necessary for its successful implementation.

[Answer any 4 points]

(c) This is a straight forward activity, but *Davenport & Short (1990)* prescribe a five-step approach to BPR:

FIVE STEPS IN PROCESS REDESIGN



(i) Develop Business Vision and Process Objectives:
BPR is driven by a business vision which implies specific business objectives such as Cost Reduction, Time Reduction, Output Quality Improvement, Quality of Work life (QWL)/Learning/Empowerment.

(ii) Identify Processes to be redesigned:
Most firms use the High-Impact approach which focuses on the most important processes or those that conflict most with the business vision. Lesser number of firms use the *Exhaustive* approach that attempts to identify all the processes within an organization and then prioritize them in order of redesign urgency.

(iii) Understand and Measure the Existing Processes:
Understanding and measuring the existing processes before redesigning them is especially important, because problems must be understood so that they are not repeated. On the other hand, accurate measurement can serve as a baseline for future improvements.

(iv) Identify IT Levers:
In the broadest sense, all of IT's capabilities involve improving coordination and information access across organizational units, thereby allowing for more effective management of task interdependence. An awareness of IT capabilities can -and should- influence process design. Therefore, the role of IT in a process should be considered in the early stages of its redesign.

(v) Design and Build a Prototype of the New Process:

The actual design should not be viewed as the end of the BPR process. Rather, it should be viewed as a prototype, with successive iterations expected and managed. Key factors and tactics to consider in process design and prototype generation include using IT as a design tool, understanding generic design criteria, and creating organizational prototypes.

These prototypes of business process changes and organizational redesign initiatives, after agreement by owners and stakeholders, would be implemented on a pilot basis, examined regularly for problems and objective achievement, and modified as necessary. As the process approached final acceptance, it would be phased into full implementation.

[Answer any 4 points]

3.(a) A Finance Manager is considering drilling a well. In the past, only 70% of wells drilled were successful at 20 metres depth in that area. Moreover, on finding no water at 20 metres, some persons in that area drilled it further up to 25 metres but only 20% struck water at that level. The prevailing cost of drilling is ₹ 500 per metre. The Finance Manager estimated that in case he does not get water in his own well, he will have to pay ₹ 15,000 to buy water from outside for the same period of getting water from the well. The following decisions are considered:

(i) Do not drill any well;
(ii) Drill up to 20 metres, and
(iii) If no water is found at 20 metres, drill further upto 25 metres.
Draw an appropriate decision tree and determine the Finance Manager's optimal strategy.

(b) Describe the Performance Prism Model in the context of evaluation of Financial and Financial and Non Financial Performance.

(c) Discuss the Risk Adjusted Discount Rate Method.

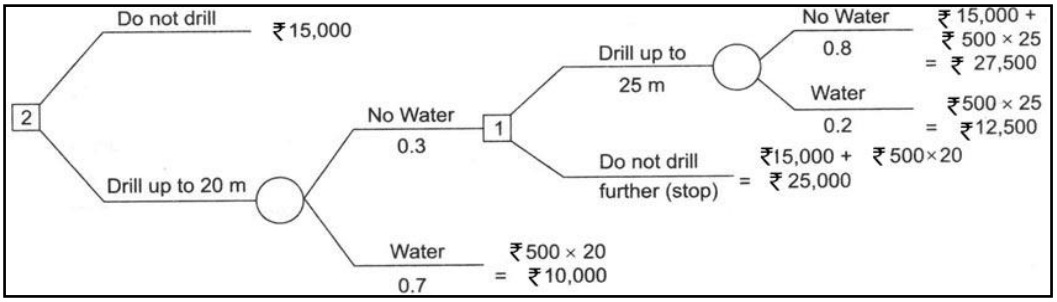
(d) From the following information Calculate EVA:

Equity Share Capital	**₹ 5,00,000**
13% Preference Share Capital	**₹ 2,00,000**
Reserves and Surplus	**₹ 6,00,000**
Non trade investments (Face Value ₹ 1,00,000), Rate of Interest	**10%**
20% Debentures	**₹ 3,00,000**
Profits before tax	**₹ 3,00,000**
Tax Rate	**40%**
WACC	**13%**

[6+4+4+6]

Answer of 3:

(a)



Decision Tree: Drilling Problem

Analysis Table: Decision Tree

Decision Node	Options	Expected Cost	Decision
1	Drill up to 25 metres Stop	0.8 x 27,500 + 0.2 x 12,500 = ₹24,500 ₹ 25,000	Drill up to 25 metres
2	Do not drill Drill up to 20 metres	₹ 15,000 0.3 x 24,500 + 0.7 x 10,000 = ₹14,350	Drill up to 20 metres

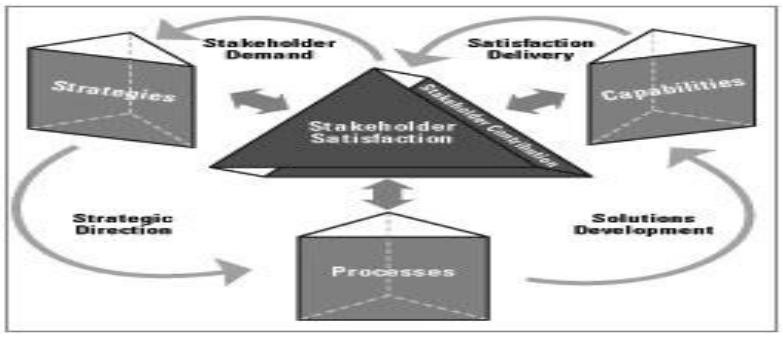
From the analysis table, it may be observed that decision at node 2 implies that if it is decided to drill up to 20 metres and water is not found, then drilling up to 25 metres should be done. At node 1, the decision taken is to drill up to 20 metres as it involved lower expected cost. Thus, the optimal strategy is to drill up to 20 metres and if water is not struck then drill further to 25 metres.

(b) Performance Prism

Performance Prism creators Andy Neely and Chris Adams maintain that the better known Balanced Scorecard framework only focuses on two sets of stakeholders: shareholders and customers. It thinks about all of their stakeholders and how organizations can deliver value to them. In the Performance Prism framework, stakeholders include: activists, communities, consumers, employees, legislators, regulators, and suppliers.

Within this methodology, practitioners focus on five major areas:

- **Stakeholder Satisfaction:** Who are the key stakeholders? What do they want and need?
- **Strategies:** What strategies does the organization need to put in place to satisfy the wants and needs of these stakeholders?
- **Processes:** What critical processes does the organization need to put in place to satisfy thesestrategies?
- **Capabilities:** What capabilities does an organization need to operate and to enhance these processes?
- **Stakeholder Contribution:** What contributions does the organization need from its stakeholders to maintain and develop these capabilities?



(c) Risk Adjusted Discount Rate Method

This method is very much akin to certainty equivalent method that is more popular. This is due to the fact that quantification of the risk premium is more concrete in this method. Normally when new investments have the same risk as existing operations, the discount rate applied is the average cost of capital of the operations. If the risk of the new project is greater, then a formula is applied for the computation of the risk adjusted discount rate, as follows:

$$r_p = r_f + n + d_p$$

Where,

r_p = Risk Adjusted discount rate for project 'p'

r_f = Risk free rate of interest

n = Premium for normal risk

d_p = Premium for additional risk differential for project 'p'

(d) Economic Value Added = NOPAT – Capital Cost

= NOPAT – (WACC x Capital Employed)

Working Note – 1

Calculation of NOPAT

Profit before tax	3,00,000
+ Interest Expense	60,000
- Non operating income	10,000

Operating EBIT	3,50,000
Less economic taxes @ 40%	1,00,000
NOPAT	2,50,000

Working Note – 2

Capital Employed

Equity Share capital	5,00,000
Reserve and surplus	6,00,000
13% preference share capital	2,00,000
20% debenture	3,00,000
Total	16,00,000
Less non operating assets	1,00,000
Capital Employed	15,00,000

EVA = 2,50,000 – (15,00,000 x 13%) = 2,50,000 – 1,95,000 = 55,000

4 (a) K Ltd. sells output in a perfectly competive market. The average variable cost function K Ltd. is AVC = 300 – 40Q + 2Q². K Ltd has an obligation to pay ₹ 500 irrespective of the output produced. What is the price below which K Ltd. has to shut down its operation in the short run?

(b) The total cost function for a monopolist is given by

$TC = 900 + 40 Q^2$

The demand function for the good produced by the monopolist is given by

$2Q = 48 – 0.08 P$

What will be the profit maximizing price?

(c) Listing the steps of the principles of Lean.

(d) Limitation of Value Chain Analysis. **[5+5+5+5]**

Answer of 4:

(a) A firm has to shut down its operation, if the price is less than average variable cost. Under perfect competition

P = MR i.e. Price is equal to Marginal Revenue.

The firm will continue its operation under the short run so long as price is atleast equal to average variable cost.

Thus the equilibrium price which the firm will shut down is the minimum AVC i.e. the Average Variable Cost.

$AVC = 300 – 40Q + 2Q^2$

AVC is minimum where $\frac{d(AVC)}{dQ} = 0$

i.e. $\frac{d(AVC)}{dQ} = - 40 + 4q = 0$

i.e. Q = 10 units.

When the firm is producing 10 units,

$AVC = 300 – 40Q + 2Q^2$

$= 300 – 40(10) + 2 (10)^2$

$= 300 – 400 + 200 = 100$

If the price falls before ₹ 100 the firm has to shut down its operation under short run.

(b) Demand function is given by

$2Q = 48 – 0.08\ P$

or , $2Q – 48 = – 0.08\ P$

or, $48 – 2Q = 0.08\ P$

or, $P = 600 – 25Q$

$TR = PQ$

$= 600Q – 25Q^2$

TC is given by,

$TC = 900 + 40\ Q^2$

The first order condition for profit maximization is MR = MC

$TR = 600Q – 25Q^2$

$MR = \frac{dTR}{dQ} = 600 - 50Q$

$MC = \frac{d(TC)}{dQ} = 80Q$

For maximizing profit

MR = MC

i.e. $600 – 50Q = 80Q$

$Q = 4.6$units

Equilibrium Price

$P = 600 – 25\ Q = 600 – 25(4.6)$

$= 600 – 115$

= ₹ 485

i.e. profit maximizing price is ₹ 485

(c) The five-step thought process for guiding the implementation of lean techniques is easy to remember, but not always easy to achieve:

- Specify value from the standpoint of the end customer by product family.
- Identify all the steps in the value stream for each product family, eliminating whenever possible those steps that do not create value.
- Make the value-creating steps occur in tight sequence so the product will flow smoothly toward the customer.
- As flow is introduced, let customers pull value from the next upstream activity.
- As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of perfection is reached in which perfect value is created with no waste.

(d) Limitations of Value Chain Analysis

(i) Non availability of Data	Internal data on costs, revenues and assets used for Value Chain Analysis are derived from financial of a single period. For long term strategic decision- making , changes in cost structures, market prices and capital investments etc. May not readily available.
(ii) Identification of stages	Identifying stages in an industry's value chain is limited by the ability to locate at least one firm that participates in a specific stage. Breaking a value stage into two or more stages when an outside firm does not compete in these stages is strictly judgment.
(iii) Ascertainment of costs of Revenues and Assets	Finding the Costs, Revenues and Assets for each value chain activity poses/gives rise to serious difficulties. There is no specific approach and much depends upon trial and error and experiments methods.
(iv) Identification of cost Drivers	Isolating Cost Drivers for each value creating activity, identifying Value chain Linkages across activities and computing supplier and customer profit margins present serious challenges.
(v) Resistance from employees	Value chain Analysis is not easily understandable to all employees and hence may face resistance from employees as well as managers.

Section – B

[Answer any 2]

5 (a) List the Advantages of these Data Envelopment Analysis.

(b) "Data quality management incorporates a virtuous cycle in which continuous analysis, observation, and improvement lead to overall improvement in the quality of organizational information across the board. This virtuous cycle incorporates five fundamental data quality management practices, which are ultimately implemented using a combination of core data services." – Discuss the five fundamentals. [5+5]

Answer of 5 :

(a) Some of the Advantages of DEA are:

- No need to explicitly specify a mathematical form for the production function.
- Proven to be useful in uncovering relationships that remain hidden for other methodologies.
- Capable of handling multiple inputs and outputs.
- Capable of being used with any input-output measurement.
- The sources of inefficiency can be analyzed and quantified for every evaluated unit.

(b) The objective of this cycle is to transition from being an organization in which the data stewards react to acute data failures into an organization that proactively controls and limits the introduction of data flaws into the environment.

(i) Data quality assessment, as a way for the practitioner to understand the scope of how poor data quality affects the ways that the business processes are intended to run, and to develop a business case for data quality management;

(ii) Data quality measurement, in which the data quality analysts synthesize the results assessment and concentrate on the data elements that are deemed critical based on the selected business users' needs. This leads to the definition of performance metrics that feed management reporting via data quality scorecards;

(iii) Integrating data quality into the application infrastructure, by way of integrating data requirements analysis across the organization and by engineering data quality into the system development life cycle;

(iv) Operational data quality improvement, where data stewardship procedures are used to manage identified data quality rules, conformance to acceptability thresholds, supported by

(v) Data quality incident management, which allows the data quality analysts to review the degree to which the data does or does not meet the levels of acceptability, report, log, and track issues, and document the processes for remediation and improvement.

6 (a) Describe about the Malm Quist Index (MI).
(b) Discuss the benefits of TPM. **[6+4]**

Answer 6:

(a) Malm Quist Index (MI)

The Malm quist Index (MI) is a bilateral index that can be used to compare the production technology of two economies. It is named after Professor Sten Malmquist, on whose ideas it is based. It is also called the Malmquist Productivity Index.

The MI is based on the concept of the Production function. This is a function of maximum possible production, with respect to a set of inputs pertaining to capital and labour. So, if is the set of labour and capital inputs to the production function of Economy A, and Q is the production function of Economy A, we could write $Q = f_a(S_a)$.

While the production function would normally apply to an enterprise, it is possible to calculate it for an entire region or nation. This would be called the aggregate production function.

To calculate the Malmquist Index of economy A with respect to economy B, we must substitute the labour and capital inputs of economy A into the production function of B, and vice versa. The formula for MI is given below.

$$\mathbf{MI} = \sqrt{(Q_1Q_2)/(Q_3Q_4)}$$

Where,

$Q_1 = f_a(S_a)$

$Q_2 = f_a(S_b)$

$Q_3 = f_b(S_a)$

$Q_4 = f_b(S_b)$

Note that the MI of A with respect to B is the reciprocal of the MI of B with respect to A. If the MI of A with respect to B is greater than 1, the aggregate production technology of economy A is superior to that of economy B.

(b)Benefits of TPM:

- A set of new management goals will be developed by the Management, using the skills and training provided during the implementation of the TPM
- Team bonding and better accountability
- Improved quality and total cost competitiveness
- Productivity and quality team training for problem solving
- Earlier detection of factors critical to maintaining equipment "uptime"
- Measure impact of defects, sub-optimal performance, and downtime using OEE (Overall Equipment Effectiveness).
- Motivated people function better all the time
- The cost is reduced because the losses and other not value added work is reduced

7. Define the following term in the context of Supply Chain Management:
(a)Capacity Utilization, (b) In source vs Outsource, (c) Logistics Management, (d) Strategic Alliance (e) Supplier Performance Evaluation. [2x5]

Answer of 7:

(a) Capacity Utilization

This is a measure (usually expressed as a percentage) of how intensively a resource is being used to produce a good or service. Utilization compares actual time used to available time. Traditionally, utilization is the ratio of direct time charged (run time plus setup time) to the clock time available.

(b) In source vs Outsource

The act of deciding whether to produce an item internally or buy it from an outside supplier. Factors to consider in the decision include costs, capacity availability, proprietary and/or specialized knowledge, quality considerations, skill requirements, volume, and timing.

(c) Logistics Management

Logistics management is the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organization and its marketing channels in such as way that current and future profitability are maximized through the cost-effective fulfillment of orders.

(d) Strategic Alliance

A relationship formed by two or more organizations that share (proprietary), participate in joint investments, and develop linked and common processes to increase the performance of both companies. Many organizations form strategic alliances to increase the performance of their common supply chain.

(e) Supplier Performance Evaluation

The main objective of the supplier evaluation process is to reduce purchase risk and maximize the overall value of the purchaser. It typically involves evaluating, at a minimum, supplier quality, cost competitiveness, potential delivery performance and technological capability. Some of the other criteria used in the preliminary evaluation of suppliers include

financial risk analysis, evaluation of previous performance, and evaluation of supplier provided information.

Section C

[Answer any 2]

8. (a) Discuss the needs for Implementation of ERM.
(b) State the objectives of Risk Management. [5+5]

Answer of 8:

(a)Need for Implementation of ERM

ERM needs to be implemented for the following reasons:

- Reduce unacceptable performance variability.
- Align and integrate varying views of risk management.
- Build confidence of investment community and stakeholders.
- Enhance corporate governance.
- Successfully respond to a changing business environment.
- Align strategy and corporate culture.

[Students may answer any 5 points out of 6]

(b)Objectives of Risk Management

Risk management basically has the following objectives:

- Anticipating the uncertainty and the degree of uncertainty of the events not happening the way they are planned.
- Channelizing events to happen the way they are planned.
- Setting right, at the earliest opportunity, deviations from plans, whenever they occur.
- Ensuring that the objective of the planned event is achieved by alternative means, when the means chosen proves wrong, and
- In case the expected event is frustrated, making the damage minimal.

9. "Just as diseases are identified by certain symptoms, industrial sickness too can be identified by some symptoms." - Justify the statement. [10]

Answer of 9:

Symptoms act as leading indicators of sickness, and if immediate remedial actions are not taken, the sickness will grow to the extent that the organization will find its natural death. There are the following indicators of sickness:

- Continuous reduction in turnover.
- Piling up of inventory,
- Continuous reduction of net profit to sales ratio.
- Short term borrowings M high interest rate,
- Continuous cash losses leading to erosion of tangible net worth,
- Default in payment of interest on borrowings and default in repayment of term loan installments.
- The 'sundry debtors' as well as the 'sundry creditors' keep growing and reaching a disproportionately high level.
- High turnover of personnel, especially at senior levels,
- Change in accounting procedure with to view to window dressing.
- Delay in finalization of accounts

10. (a) From the following information, calculate of the Z-Score of a company :

Sales	**25,978**
Total Assets	**49,579**
Total Liabilities	**5,044**
Retained Earnings	**177**
Working Capital	**-1,777**
Market Value of Equity	**2,605**
Book Value of Total Liabilities	**5,044**

(b) Discuss about Probability of Ruin **[6+4]**

Answer of 10:

(a) The Calculations of the Ratios are as follows:

1. Working Capital/Total Assets (-1,777/ 49579) = -0.036

2. Retained Earnings/Total Assets (177/ 49579) =0.004

3. Earnings Before Interest & Tax/ Total Assets (2605/ 49579)= 0.053

4. Market Value of Equity/ Total Liabilities (10098/ 5044)= 2.00

5. Sales/Total Assets (25978/ 49579)=0.52

We know,
Z=1.2WC/TA + 1.4 RE/TE + 3.3 EBIT/TA + 0.6 MVE/TL + 1.0 SL/TA

Thus according to the formula the answer should be:
Z=1.2(-0.036) + 1.4 (0.004) + 3.3 (0.053) + 0.6 (2.0) + 1.0(0.52)
Z= - 0.04+ 0.0056 +0.17 +1.20 + 0.52
Z=1.86

We know,
Probability of Failure According to the Z-Score Result:

Z-Score	Probability of Failure
Less than 1.8	very High
Greater that 1.81 but less than 2.99	Not Sure
Greater than 3.0	Unlikely

According to Altman, this company may or may not fail as it is greater than 1.81 but less than 2.99, which situates it neither on the safe side nor on the failure side.

(b) Probability of Ruin:

Ruin theory also known as collective risk theory, was actually developed by the insurance industry for studying the insurers vulnerability to insolvency using mathematical modeling. It is based on the derivation of many ruin-related measures and quantities and specifically includes the probability of ultimate ruin. This can be also related to the sphere of applied probability as the techniques used in the ruin theory as fundamentally arising out of stochastic processes. Many problems in ruin theory relate to real-life actuarial studies but the mathematical aspects of ruin theory have really been of interest to actuarial scientists and other business research people.

Normally an insurers' surplus has been computed as the net of two opposing cash flows, namely, cash inflow of premium income collected continuously at the rate of c and the

cash outflow due to a series of insurance claims that are mutually independent and identically distributed with a common distribution function P(y). The path of the series of claims is assumed to respond to a Poisson process with intensity rate □ which would mean that the number of claims received N(t) at a time frame of t is controlled by a Poisson distribution with a mean □t. Therefore, the insurer's surplus at any time t is represented by the following-formula:

$$X(t) = x + ct - \sum_{i=0}^{N(t)} Y_i$$

Where, the business of the insurer starts with an initial level of surplus capital.

X(0) = x under probability measure as explained in the previous paragraph.

In short, this theory of the probability of ruin is applied in the case of risk of insolvency of a company with diversified business activity. For the purpose of study, resources between diversified activities are allowed to be transferred and are limited by costs of transaction. Terminal insolvency happens when capital transfers between the business lines are not able to compensate the negative positions. Actuarial calculations are involved in the determination of ultimate ruin as discussed.