Issue	Points to remember		Page
Target Cost Merits	1. Competitive Advantage, 2. Real Cost Reduction	3. Innovation, 4. Market Driven Management	9.4
Target Cost – Demerits	1. Time Factor, 2. Responsibility for Cost Reduction, 3. Co–ordination		9.5
Role of Cost Accountant in Target Cost	1. Cost Estimation, 2. Permissible Cost Ranges, 3. Capital Budgeting Analysis,	4. Cost Principles Explanation, 5. Review of Cost Reduction Targets, 6. Final Review and Feedback	9.5
Target Costing Data	**Features:** 1. Non–Traditional, 2. Futuristic, 3. Poorly defined, and 4. Unorganised. **Sources:** 1. Market and Competitor Information, 2. Competitor Cost Information, 3. Data from Past Analysis, 4. Engineering Data, and 5. Supplier Data.		9.5
Control Points	1. Principal Control Point, 2. Decision Point, i.e. Point of Go or No Go Decision, 3. Milestones		9.6
Target Costing in Service Sector	1. In Service Sector, the Target Costing Team can observe and analyse the actual provision of services to customers, and provide suggestions for cost reduction, by re–configuring / streamlining the activities performed by employees in the course of rendering the service. 2. Application of Target Costing at the "Production" phase in Service Sector, will – (a) lead to cost and wastage reduction, (b) improve productivity of employees, and (c) enhance the quality of services provided to customers.		9.7
Cost Reduction	1. **Meaning:** Cost Reduction is defined as achievement of **real and permanent reduction**, in the **unit cost** of goods manufactured or services rendered, without impairing their **suitability** for the use intended or diminution in the quality of the product. 2. **Focus:** Reduction in expenditure and Increased Productivity. 3. **Advantages:** (a) **Individual Firm** – Improvement in profits and enhancement in value of shares, (b) **Society** – Availability of goods and services of proper quality at reasonable prices, and (c) **Country as a whole** – Reduction in cost, Increase of Market Share in Exports and increased Forex Savings, and Increase in Government's Tax Revenue.		9.7
Cost Control vs Reduction	**Refer Q.No.16**		9.7
Cost Redn Plan – Steps	**Step 1:** Definition of Targets, **Step 2:** Formulation of Program,	**Step 3:** Implementation, **Step 4:** Control and Review	9.9
Value Engineering (VE) and Value Analysis (VA)	• **Value Engineering:** Searching for opportunities to modify the design of each component or part of a product, to reduce cost, but without reducing product's functionality or quality. • **Value Analysis:** Studying the activities involved in producing the product to detect NVA activities that may be eliminated or minimized to save costs, but without reducing the functionality or quality of the product.		9.9
VA / NVA Costs	• **VA Costs:** If eliminated, this would reduce the value or utility (usefulness) customers obtain from using the product or service. • **NVA Costs:** If eliminated, this would not reduce the value or utility (usefulness) customers obtain from using the product or service.		9.9
Issues analysed in VA & VE	1. Elimination of unnecessary functions from the production process, 2. Elimination of unnecessary product qualities, 3. Design Minimisation, 4. Better product design to suit manufacturing process, 5. Substitution of Parts (Component Part Analysis), 6. Combination of steps (Process Centering), 7. Search for better way of doing things.		9.9
Cost Reduction Aspects	• Cost Reduction Aspects in **Material Cost** – (1) General Control Procedures, (2) Working with Suppliers, (3) Material Movement, (4) Product Design • Cost Reduction Aspects in **Plant / Production Areas** – (1) Plant Layout, (2) Production Planning, (3) Accident Prevention, (4) Automation, (5) Quality Control, (6) Production Control, (7) Operating Efficiency. • Cost Reduction Aspects in **Labour Cost** – (1) Reporting by Cost Accountant, (2) Job Evaluation, (3) Time and Motion Study, SIMO Charts, etc. • Cost Reduction Aspects in **Other Areas** – (1) Works Services, (2) Operations Research Techniques, (3) Organisation Structure, (4) Co–ordination		9.10–9.14

FTR 10 Life Cycle Costing

Issue	Points to remember					Page
Product Life Cycle – Phases	**Particulars**	**Introduction**	**Growth**	**Maturity**	**Decline**	10.1
	Phase	**I**	**II**	**III**	**IV**	
	Sales Volumes	Low.	Rise at increasing rates.	Rise at decreasing rates.	Constant & then start decreasing.	
	Prices of products	High levels.	Retention of high level prices	Prices fall closer to Cost.	Gap between Price & Cost is reduced.	
	Sales Values	Low, due to low sales quantities.	Rise in Sales Values at increasing rates.	Rise in Sales Values at decreasing rates.	Sales Value starts decreasing.	
	% of SOH to Sales	Highest	Total Expenses remain same, while ratio of S&D OH to Sales is reduced.	Ratio reaches a normal % of sales, which becomes industry standard.	Reduced sales promotional efforts.	
	Competition	Negligible & insignificant.	Entry of large no. of competitors.	Fierce Competition.	Starts disappearing.	
	Profits	Nil.	Increase at a rapid pace.	Normal rate of profits.	Declining profits.	
	Major Cost Items	R&D, Design Costs, Promotional Costs, Capacity Costs	Manufacturing Costs, Distribution Costs, Product Support Costs	Manufacturing Costs, Distribution Costs, Product Support Costs	Plants re–used / sold / scrapped / related costs	
Product Life Cycle – Features	1. Finite lives, 2. Follow predictable courses, 3. Profit p.u varies for each product,			4. Different opportunities and threats, 5. Functional emphasis in each phase, 6. Extend life of the product		10.2
Product Life Cycle – Stages	1. Market Research, 2. Specification, 3. Design, 4. Prototype manufacture,		5. Development, 6. Tooling, 7. Manufacture, 8. Selling,		9. Distribution, 10. Product support, 11. Decommissioning or Replacement	10.3
Product Life Cycle – Importance	1. Time based analysis, 2. Overall Cost Analysis, 3. Pre–production costs analysis, 4. Effective Pricing Decisions,			5. Better Decision Making, 6. Long Run Wholistic view, 7. Life Cycle Budgeting, 8. Review		10.3

FTR 11 Total Quality Management

Issue	Points to remember		Page
Steps in TQM	**Step**	**Description**	11.1
	1	Identification of customers / customer groups.	
	2	Identification of customer expectations.	
	3	Identification of customer decision–making requirements and product utilities.	
	4	Identification of perceived problems in decision making process and product utilities.	
	5	Comparison with other organisations and Benchmarking.	
	6	Customer Feedback.	
	7	Identification of improvement opportunities.	
	8	Quality Improvement Process through – (a) Determination of new strategies, (b) Elimination of deficiencies, and (c) Identifying solutions.	
PRAISE	1. Problem Identification, 2. Ranking, 3. Analysis, 4. Innovation, 5. Solution, 6. Evaluation For smooth PRAISE implementation, – (a) Move from Small to Big Issues, (b) Take Solvable Problems, and (c) Recognise Participants		11.2

Issue	Points to remember			Page
6 C's	1. Commitment, 2. Culture,	3. Continuous improvement, 4. Co–operation,	5. Customer Focus, 6. Control	11.4
4 P's	1. People, 2. Process, 3. Problem, 4. Preparation			11.4
Cost of Quality	1. Costs of Quality Compliance: (a) Prevention Costs, (b) Appraisal Costs, 2. Costs of Quality Non–Compliance: (a) Internal Failure Costs, (b) External Failure Costs			11.4
Conti. Process Imprv ment	1. Continuous Process Improvement believes in encouraging every member of the Firm to continuously strive to efficiently serve their customers, who may either be external or internal. 2. The challenge is in promoting activities that continuously modify processes, procedures, task, content and process interfaces to achieve complete customer satisfaction as well as to reduce costs and to increase product quality.			11.5
TQM Princi–ples	1. Clear exposition of benefits of project. 2. Total Employee involvement (TEI). 3. Process measurement. 4. Involvement of all customers & contributors. 5. Elimination of irrelevant data.	6. Understanding the needs of the whole process. 7. Use of graphical & pictorial techniques to achieve understanding. 8. Establishment of performance specifications & targets. 9. Use of errors to prompt continuous improvement. 10. Use of statistics to tell people how they are doing.		11.5
TQM Benefits	1. Increased awareness of Quality Culture in the Firm, 2. Commitment to Continuous Improvement, 3. Greater focus on Customer Satisfaction, 4. Greater emphasis on Team Work, and 5. Better Control over processes, operations and costs.			11.5
Control in TQM	1. Process Definition, 2. Database, 3. Quality Manual, 4. Improved decisions, 5. Control and Continuous Improvement, and 6. Use of Control Reports			11.5
Focus lost in TQM	1. Focus on documentation of process and ill–measurable outcomes, 2. Emphasis on quality assurance rather than improvement, and 3. Internal focus which is at odds with the alleged customer orientation.			11.6
TEI	Reviving the Customer Focus with Total Employee Involvement (TEI), oriented towards organisational goals, will involve the following areas of thrust – 1. Loyalty to the vision of the Company through the pursuit of tough, visible goals. 2. Recognition of satisfied customers and motivated employees as true assets of a Company. 3. Delegation of decision–making to the point of responsibility by eliminating hierarchical tiers of authority to allow direct and speedy response to customer needs. 4. Decentralisation of Management to make best use of the creative energy of the workforce.			11.6

FTR 12 Theory of Constraints

Issue	Points to remember	Page
Optimised Production Technology (OPT)	1. OPT is based on the principle that profits are expanded by increasing the Throughput of the Plant, i.e. rate at which Raw Materials are turned into Sales. So, Throughput Contribution = Sales Revenue less Direct Materials Cost. 2. The OPT Approach determines what prevents Throughput being higher, by distinguishing between – (a) Bottleneck, and (b) Non–Bottleneck Resources. 3. The most widely recognised management accounting system developed for this purpose is known as Throughput Accounting (TA).	12.1
Theory of Constraints	1. TA Concept assumes that a Firm has a given set of resources available (e.g. Buildings, Capital Equipments and Labour Force). The Operating Costs of these resources (i.e. Labour and Overheads) are considered as Fixed Cost. 2. Using these resources, purchased materials and components should be processed to generate Sales Revenue. To achieve this, the Firm has to maximise Throughput Contribution (i.e. Sales Revenue Less Direct Materials), subject to – (a) Production Capacity (Supply Constraints), and (b) Sales Demand (Demand Constraints).	12.1
TOC – Key Measures	1. Throughput Contribution, 2. Investments (Inventory) & 3. Other Operating Costs	12.1
Bottleneck	Activity within the Firm where the demand for that resource is more than its capacity to supply.	12.1

Issue	Points to remember	Page
Constraint	It is a situational factor, which makes the achievement of objectives/throughput more difficult than it would otherwise be.	12.1
Key Steps in Managing Bottlenecks	1. Identify System Bottlenecks, i.e. highest TA Ratio = $\frac{\text{Resource Requirement}}{\text{Resource Availability}} \times 100$. 2. Describe how to exploit the bottlenecks 3. Sub–ordinate decisions 4. Bottleneck Removal or Improvement – (a) Remove the bottleneck, (b) Increase bottleneck efficiency and capacity.	12.2

FTR 13 JIT, MRP and Production Concepts

Issue	Points to remember	Page
	JUST IN TIME CONCEPT	
JIT in Finished Goods	1. Standardisation of Finished Products, 2. Identification of Sales and Production capacities, 3. Finalisation of Despatch Schedule, 4. Simplification of Process Cycle, 5. Finalisation of Production Schedule, 6. JIT Stores Requisition	13.1
JIT in Raw Materials – Additional Steps	1. Standardisation of Raw Materials & Components 2. Make or Buy decision 3. Standardisation of Supplier List 4. Streamlining Purchase process 5. Firm Contracts 6. Supplier Assistance 7. Supplier Information System 8. Reviewing Logistics 9. JIT Ordering 10. Direct Delivery	13.2
JIT in WIP	1. Affects Cost – (a) Piling up of WIP Inventory, (b) Delayed Tracing of Defectives 2. Ways to Resolve – (a) Kanban Card, (b) Working Cells	13.2
JIT – Objectives	1. Waste Reduction, 2. Time Reduction, 3. Elimination of NVA activities, 4. Zero Inventory, 5. Zero Defects, 6. Zero Break–downs, 7. Economical Batch Sizes, 8. Product Quality, 9. Timely delivery to Customer.	13.3
JIT – Benefits	1. Reduction in Inventory Levels, 2. Reduction in Wastage of Time, 3. Reduction in Scrap Rates, 4. Reduction in OH Costs	13.3
JIT – Time Reduction	1. Storage Time, 2. Inspection Time, 3. Handling Time, 4. Queue Time	13.3
JIT Effect on OH	1. Thorough reduction in Overhead Costs, 2. Shift between Overhead Costs and Direct Costs, due to introduction of Machine Cells, and 3. Scientific Allocation of common Overheads based on Machine Cells and Cost Drivers.	13.4
JIT Other Effects	1. Lower Inventories and Associated Costs. 2. Better Product Pricing (Customers' Needs and Competitors' Effect) 3. Reduced Capital Requirements.	13.5
Performance Measure–ment Criteria	1. Inventory Turnover, 2. Setup Time Reduction, 3. Customer Complaints, 4. Scrap, 5. Cost of Quality, 6. Customer Service, 7. Ideas generated	13.6
Backflushing	• **Meaning:** Backflush Costing is a costing system that omits recording some or all of the journal entries relating to the cycle from purchase of Direct Materials to the sale of Finished Goods. The Journal Entries for the subsequent stages use normal or standard costs to work backward to flush out the costs in the cycle for which Journal Entries were omitted earlier. • **Issues:** 1. Production Reporting, 2. Scrap Reporting, 3. Lot Tracing, 4. Inventory Accuracy	13.7
	MATERIAL REQUIREMENTS PLANNING (MRP–I)	
MRP Meaning	Computerised Production Scheduling System providing a basis for production decisions. Involves Input (RM) Planning based on Output (FG) Budget.	13.8
Aims / Objectives / Benefits of MRP	1. Determine quantity & timing of FG production. 2. Ascertain quantity of Raw Materials, sub–assemblies & Components required. 3. Compute inventories, WIP, batch sizes & manufacturing & packaging lead Times. 4. Control inventory by ordering bought–in Components & Raw Materials. 5. Forecast inventory position period–by–period.	13.8

Issue	Points to remember		Page
	6. Serve as Inventory Information System. 7. Generate Purchase Requisition Notes and Purchase Orders.		
Pre–requisites	1. Production Schedule, 2. Standard Material Input,	3. Workers co–operation, 4. Accuracy of data	13.8
Reqments for MRP Operation	1. Master Production Schedule, 2. Bill of Materials (BOM), 3. Inventory File/Stores Ledger,	4. Routing File, 5. Master Parts File	13.9
OTHER PRODUCTION CONCEPTS			
MRP–II	When the scope of MRP–1 is developed further to include – (a) planning for Raw Materials, Components and Sub–Assemblies, (b) computation of other resources, e.g. Machine or Labour Capacity, and (c) creation of a **full integrated plan** for Management, then it is known as Manufacturing Resources Planning (MRP–2 or MRP–II).		13.10
Computer Aided Manu–facturing	1. When the manufacturing process is carried out by a range of machinery that, together with its concomitant software, comes under the collective heading of Computer–Aided Manufacturing (CAM). 2. Elements of CAM are – (a) Computer Numerical Control (CNC), and (b) Robotics. 3. CNC Machines are Programmable Machine Tools. These are capable of performing a number of machine tasks, e.g. cutting, grinding, moulding, bending, etc. CNC offers greater flexibility, and reduces set–up times.		13.10
Synchronous Manu–facturing	Synchronous Manufacturing Philosophy requires Managers to focus on those areas of operations where potential global improvements exist. Its Principles are – 1. Do not focus on balance Idle Capacities. Focus on synchronizing the Production Flow. 2. Marginal Value of Time at a Bottleneck Resource = Throughput Rate of the Products processed by the Bottleneck. 3. Marginal Value of Time at a Non–Bottleneck Resource is negligible. 4. The level of utilization of a Non–Bottleneck Resource is controlled by other constraints within the system. 5. Resources must be **utilized**, not simply activated. 6. A Transfer Batch may not, and many times should not, be equal to the Process Batch. 7. A Process Batch should be variable both along its route and over time.		13.10
BPR	**Meaning:** Business Process Re–Engineering refers to the analysis and re–design of workflows and processes both within and between business Firms. It is a total deconstruction and re–thinking of a business process in its entirety, unconstrained by its existing structure and pattern. **Purpose:** The aim of BPR is to improve key business processes in a Firm by focussing on – (a) Simplification, (b) Cost Reduction, (c) Improved Quality, and (d) Enhanced Customer Satisfaction.		13.11

FTR 14A Value Chain Analysis

Issue	Points to remember		Page
Activity Classification	1. Primary or Line Activities – (a) Material Handling, (b) Conversion, (c) Order Processing and Distribution, (d) Communication, pricing and Channel Mgmt, (e) Installation, Repair, Service. 2. Support Activities – (a) Procurement, (b) Technology Development, (c) HR Mgmt, (d) Admn.		14.1
Forms of Competitive Advantage	**Differentiation Advantage**	**Low–Cost Advantage**	14.3
	Occurs when customers perceive a Firm's product is of higher quality, involves less risk and / or outperforms competing products.	A Firm enjoys a relative low–cost advantage if its total costs are lower than the market average.	
	Offer customers better value for equivalent price.	Offer customers equivalent value for lower price.	
	Gained by – 1. Ability to deliver goods in a timely manner, 2. Better quality, 3. Provision of after–sales support services 4. Offer wide range of goods & services.	**Gained by –** 1. Access to low–cost raw materials, 2. Innovative process technology, 3. Low–cost access to distribution channels 4. Economies of scale, 5. Superior Operating Management, etc.	

Issue	Points to remember		Page
	Exploited by – 1. Increasing prices until it offsets improvement in customer benefits, or 2. Pricing below the 'full premium' level to build market share.	**Exploited by –** 1. Pricing the products lower than its competitors' to gain market share & maintain current profitability, or 2. Matching with the price of competing products and increase its profitability.	
Steps in VCA	1. Internal Cost Analysis, 2. Internal Differentiation Analysis, 3. Vertical Linkage Analysis		14.3
Internal Cost Analysis – Steps	1. Identify the Firm's value–creating processes. 2. Determine portion of Total cost of product/ service attributable to each value creating unit. 3. Identify the cost drivers of each process 4. Identify the links between processes. 5. Evaluate the opportunities for achieving relative cost advantage.		14.4
Internal Differentia–tion Analysis	1. Identify the Customers' value–creating processes 2. Evaluate Differentiation Strategies for enhancing Customer Value 3. Determine the best sustainable differentiation strategies		14.5
Vertical Linkage Analysis – Steps	1. Identify the Industry's Value Chain and assign Costs, Revenues and Assets to value–creating processes. 2. Diagnose the Cost Drivers for each value–creating process. 3. Evaluate the opportunities for sustainable competitive advantage.		14.5
Industry Structure Analysis	1. Bargaining Power of Buyers 2. Bargaining Power of Suppliers 3. Threat of Substitute Products or Services	4. Threat of New Entrants 5. Intensity of Competition	14.6
Core Competencies Analysis	1. Created by superior integration of technological, physical & human resources. 2. Represent distinctive skills, intangible, invisible, intellectual assets & cultural capabilities. 3. Core Competence–based diversification reduces risk & investment, & increases the opportunities for transferring learning & best practice across business units. 4. Core Competence is identified by – Leverage Test, Value Enhancement Test, Imitability Test. 5. Steps in VCA approach for competitive advantage includes the following – (a) Validate core competencies in current businesses. (b) Export or leverage Core Competencies to the Value Chains of other existing businesses. (c) Use Core Competencies to reconfigure the Value Chains of existing businesses. (d) Use Core Competencies to create new Value Chains.		14.6
Segmen–tation Analysis – Steps	1. Identify segmentation variables and categories 2. Construct a Segmentation Matrix 3. Analyse Segment Attractiveness 4. Identify Key Success Factors for each segment 5. Analyse attractiveness of Broad versus Narrow Segment Scope		14.7
Limitations of VCA	1. Non–availability of data, 2. Identification of Stages, 3. Ascertainment of Costs, Revenues & Assets,	4. Identification of Cost Drivers, 5. Resistance from Employees, 6. Science Vs. Art	14.8
Role of Mgmt Accountant in VCA	1. Need for Education, training & awareness, 2. Exploring for information, 3. Creativity,	4. System Design, 5. Cooperation	14.8
VCA Vs. Traditional Accounting Systems	**Tradnl Mgmt A/cing** 1. Internal Focus 2. Seeks cost reduction in "Value Added" process. 3. Use of Single Cost Driver 4. Application at overall Firm level 5. Seeks adhoc cost reduction solutions for Cost Containment. 6. Focus on control of manufacturing costs. 7. Internal Information is used. 8. Inter–Firm comparison partially present.	**Value Chain Analysis** External Focus Seeks "Competitive Advantage" based on entire set of linked activities. Multiple Structural & Executional Drivers used. Unique Cost Drivers for each value activity. Cost Containment as a function of the cost drivers regulating each value activity. Focus on gaining competitive advantage. External and internal information are used. Focus on full–fledged benchmarking.	14.9

FTR 14B Performance Measurement

Issue	Points to remember			Page
Responsibility Centre	1. **Meaning:** (a) Activity centre of a business organisation entrusted with a special task, (b) Unit of function of a business organisation headed by an executive responsible for its performance. 2. **Types:** (a) Cost, (b) Revenue, (c) Profit, and (d) Investment Centres.			14.9
Responsibility Accounting	1. Control system of management accounting and reporting. 2. Involves the creation / recognition of various responsibility centers. 3. Standards of performance are clearly defined. 4. Furnishing of performance report at periodical intervals. 5. Actuals compared with standards to identify deviations & initiate appropriate action.			14.10
Pre requisites for Resp. Accounting	1. Area of responsibility and authority of each Responsibility Centre 2. Set of goals	3. Performance Report 4. Items which may require Management's attention		14.10
Limitations	1. Difficulty in preparation of an organisation chart. 2. Conflict of individual interest with organisational interest. 3. Passive resistance to the reporting system.			14.10
Responsibility Budgeting	1. **Meaning:** Budgetary Control System wherein a budget is prepared for each responsibility centre, showing the performance expected of the Responsibility Centre Manager. 2. **Principles**: (a) Goal Congruence, (b) Autonomy, and (c) Performance Appraisal.			14.10
Balanced Score Card (BSC)	Set of financial and non–financial measures relating to a Company's critical success factors. Objective – to provide a comprehensive framework for translating a Firm's strategic objectives into a coherent set of performance measures.			14.10
Advantages of BSC	1. Wholistic approach 2. Overall Agenda 3. Objectivity	4. Management By Objectives 5. Feedback and Learning 6. System Approach		14.11
Perspectives of BSC	1. Customer Perspective 2. Internal Perspective	3. Innovation and Learning Perspective 4. Financial Perspective		14.11
Process of creating BSC	1. Identify the Firm's Vision 2. Identify the Firm's Strategies 3. Define Critical Success Factors and Perspectives	4. Identify Measures to ensure everything is as planned. 5. Evaluation of Balanced Score Card 6. Create Action Plans 7. Follow up and Manage		14.11
Failure of BSC	1. Non–financial Aspects 2. Need for Trade–offs 3. Objective and Subjective Measures	4. Non Consideration of IT and R&D 5. Performance Evaluation		14.12
BENCHMARKING				
Meaning	Process of identifying and **learning** from the best practices anywhere in the world.			14.13
Types	1. Competitive 2. Strategic 3. Global	4. Process 5. Functional 6. Internal	7. External 8. Intra–Group 9. Inter–Industry	14.13
Stages	1. Planning 2. Collection of Data and Information 3. Analysis of findings based on data collected in St. 2		4. Formulation and implementation of recommendations 5. Constant monitoring and reviewing	14.14
Pre requisites	1. Commitment 2. Clarity of Objectives 3. Appropriate Scope		4. Resources 5. Skills 6. Communication	14.15
Difficulties	1. Time consuming 2. Lack of Management support 3. Resistance from Employees		4. Paper Goals 5. Copy–Paste attitude	14.15
Code of Conduct	1. Principle of Legality 2. Principles of Exchange 3. Principle of Confidentiality 4. Principle of Use		5. Principle of first Party Contact 6. Principle of Third Party Contact 7. Principle of Preparation	14.15

FTR 15 Uniform Costing & Inter Firm Comparison

Issue	Points to remember	Page
	UNIFORM COSTING	
Meaning	Adoption of common costing principles, techniques, methods and/or practices by various Firms in the same industry. Basic purpose is to facilitate better cost comparison, cost reduction and control.	15.1
Purposes	1. Standardisation, 2. Healthy Competition, 3. Inter–Firm Comparison, 4. Production Capacity, 5. Cost Information to Government, and 6. Cost Control.	15.1
Pre–conditions	1. Standardisation, 2. Willingness to share data, 3. Exchange of developments, 4. Experience and Leadership Roles, 5. Trust and Co–operation.	15.1
Areas of uniformity	1. Size, 2. Accounting Method, Principles and Procedures, 3. Production Method	15.2
Advantages	1. Costing System based: (a) Implementation, (b) Savings in individual effort. 2. Benefits to Industry: (a) Efficiency, (b) Sharing of Cost, (c) Sharing Know–how, (d) Reduction of Labour Turnover, (e) General Industry Representations. 3. Benefits to Individual Firms: (a) Performance Analysis, (b) Elimination of Unhealthy Competition, (c) Inter–Firm Comparison. 4. Other Benefits: (a) Fair Prices, (b) Price Determination.	15.2
Limitations	1. Mis–use, 2. Impracticable to small Firms, 3. Confidentiality Loss, 4. Standardisation shortage	15.3
Uniform Cost Manual Contents	1. Statement of Objectives and purpose of the system, scope of the system, advantages and extent of co–operation necessary. 2. General principles of accounting, nature of coding, terminology to be followed, classification and description of accounts. 3. Details of Stock, Labour, OH – methods of cost collection & procedures of cost control. 4. Essential cost data and various ratios to be computed for comparison of performance and efficiency in the operation of the participating units. 5. Mode, format and time for presenting cost data and reports to the Management. 6. Guidelines on treatment of depreciation, interest on capital, wastage, scrap, by–product, etc.	15.3
	INTER FIRM COMPARISON	
Meaning	Inter–Firm Comparison is a technique of evaluating – (1) Performance, (2) Efficiency, (3) Costs, and (4) Profits, of various Firms in an industry.	15.3
Pre–conditions	1. Creation of a centre for Inter–Firm Comparison, 2. Grant of Membership to all Firms, 3. Nature of information, 4. Method of collection and presentation of information	15.3
Advantages	1. To Industry, 2. To Individual Firm, 3. To Others	15.4
Limitations	1. No Utility, 2. Unreliability of data, 3. Lack of Basis for Comparison, 4. Loss of Confidentiality	15.4

FTR 16 Assignment

1	Ensure **Objective = Minimisation**. If not, convert into **Opportunity Loss Matrix**, by subtracting each element from the highest element from the Maximisation Matrix.
2	Ensure Data is **balanced** (i.e. No. of Rows = No. of Columns). If not, insert Dummy Row or Column with Zero entries.
3	Perform **Row Operations**, i.e. Subtract smallest element of each Row from all elements of that Row.
4	Perform **Column Operations**, i.e. Subtract smallest element of each Column from all elements of that Column.
5	Draw **minimum number** of horizontal and vertical lines to cover all Zeroes in the Matrix. Optimal Assignment possible only if No. of lines = Order of Matrix.
6	When No. of Lines < Order of Matrix, identify Least Open Element (LOE). Re–write Matrix as under – (a) Open Elements: Previous Element **Less** LOE, (b) Covered Elements: No change, (c) Junction Elements: Previous Element + LOE. Repeat Step 5 for such Revised Matrix till Number of Lines = Order of the Matrix.
7	**Optimal Assignment:** Identify row with one zero, draw a box around that zero, cancel all zeroes in that column, repeat procedure with columns and complete the assignment.

Special Cases and Treatment

Maximisation Objective	Convert into Opportunity Loss Matrix.
Unbalanced Matrix	Introduce Dummy Row or Column with all entries equal to zero.
Prohibited Assignment (Restrictive Condition)	Such routes are given a high cost "**M**", where M = Infinity Cost. Restrictive Condition means that such assignment is not possible, i.e. should not be made.
Condition Assignment (Facilitative condition)	Delete that Row and Column and reduce the matrix and continue the procedure. Facilitative Condition means that such assignment should be made only as given / specified.

FTR 17 Transportation

I	1. Ensure Objective = Minimisation. If not, convert into Opportunity Loss Matrix, by subtracting each element from the highest element from the Maximisation Matrix. 2. Ensure Data is balanced (i.e. Row Qtty = Column Qtty). If not, insert Dummy Row or Column with Zero entries.
II	Determine Initial Basic Feasible Solution (IBFS) by – (a) Northwest Corner Rule, (b) Least Cost Cell Method, or (c) Vogel's Approximation Method (VAM). VAM consists of the following steps – 1. Compute **Cost Differences** for each Row and Column. In case of tie, Cost Difference = 0. 2. Ascertain the **maximum** of Cost Differences and **select** that Row or Column for allocation. 3. Choose the **Least Cost Cell** in the **selected** Row or Column for allocation. 4. Compare availability and requirement for that cell, and allocate **whichever is less**, to that cell. 5. Cancel the Row or Column where availability or requirement condition is satisfied. 6. Compute Cost Differences for the resultant matrix and **repeat** the above procedure till all row availability and column requirements are satisfied.
III	**Optimality Test** consists of preparing the following tables – **Table 1: U + V for Allocated Cells:** Computation of margin numbers, 'U' and 'V' for all rows and columns such that U + V = Cost of Allocated Cells. **Table 2**: U + V for Unallocated Cells **Table 3: Net Evaluation Table (NET) = Δij Table or Decision Table** = Table 1 **minus** Table 2.

Interpretation of Solution:

NET Entries	Nature of solution
• If all numbers are positive (i.e. > 0)	IBFS is **optimal and unique.**
• If all numbers are non–negative (i.e. ≥ 0) i.e. one or more of the cells contains **zero.**	IBFS is **optimal but not unique.** As many zeroes, that many alternative solution(s) exist. (Total number of solutions = Number of Zeroes + 1)
• If any one number is negative	Solution is not optimal. Re–allocation (Loop Procedure) should be made to determine Alternative Basic Feasible Solution (ABFS).

Loop Procedure for Re–Allocation and ABFS:

1. Identify the **worst negative** in Table 3. If there is a tie, choose the Least Cost Cell. (Call this as "**Origin**")
2. Draw a **Loop** with the following principles –
   (a) Loop should commence from and end in the selected worst negative cell, i.e. the Origin.
   (b) It should have only Allocated Cells as its other Corners. (But the Loop can cross over Allocated/ Unallocated Cells.)
   (c) Only horizontal and vertical lines (not diagonal) can be used.
   (d) Loop should result in an even–sided figure.
3. Put positive (+) sign and negative (–) sign to the corners of the loop alternatively, with origin as +ve corner.
4. Re–allocation is done as under –
   (a) Identify the allocations to the negative corners of the loop (i.e. corners marked with (–) sign).
   (b) Select the minimum quantity out of the above allocations. Let this Quantity be called **Selected Quantity.**
   (c) Add this Selected Quantity to (+) corners and subtract this Selected Quantity from (–) corners. Other Allocated and Unallocated Cells will remain unaffected.

Special Cases and Treatment

Situation	Treatment
Unbalanced Data	Introduce Dummy Row or Column to balance availability and requirement.
Maximisation Objective	Convert into Opportunity Cost Matrix with Minimisation Objective, for allocation procedure.

Situation	Treatment
Degeneracy	• Optimality Test can be done only if number of allocations = [No. of Rows + No. of Columns – 1] (i.e. m + n – 1) • If Number of Allocations < (m + n – 1), all U and V numbers cannot be computed. This situation is called **Degeneracy**. • If IBFS is degenerate, introduce a **dummy allocation** (e), a small number very close to zero, in the Least Cost Independent Unallocated Cell. (where e = 0.000.....001)
Existence of Zeroes in the Net Evaluation Table	• Indicates the availability of alternative solutions (provided all other numbers are positive) • The alternative optimal solution(s) can be determined by drawing a loop commencing from such cell having zero in Net Evaluation Table. • Re–allocation will be based on the loop drawing procedure.
Prohibited Routes	Prohibited routes are identified with a high cost represented by "∞" or "M", M = Infinity Cost.

FTR 18 Linear Programming

Issue	Points to remember			
Meaning & conditions	Mathematical Model dealing with the use or allocation of certain scarce resources (i.e. Key Factor) in the best possible manner in order to maximize profit or minimize cost. **Conditions:** 1. Objective Function (Z) should be defined by use of a **linear function** involving the decision variables. 2. Decision Variables must be **non–negative.** 3. Constraints denoted by **inequations**.			
Application Areas	1. Industrial Applications 2. Product Distribution 3. Marketing Applications 4. Financial Applications		5. Administrative Applications 6. Agriculture Applications. 7. Operational Scheduling Applications	
Disadvantages	1. Existence of non–linear equations 2. Interaction between variables		3. Fractional Values 4. Knowledge of co–efficients of the equations	
Methods	1. Graphical, 2. Trial & Error Method/Algebraic Approach & 3. Simplex Method			
Slack, Surplus and Artificial Variables	**Particulars**	**Slack**	**Surplus**	**Artificial**
	1. Meaning	Idle or Unused Resources.	Excess Amount of resources utilized.	No physical or economic meaning. It is fictitious.
	2. When Used	'≤' inequality	'≥' inequality	'≥' and '=' constraints
	3. Co–efficient in the constraint	**+1**	**–1**	**+1**
	4. Co–efficient in the Obj. Function Z	0	0	+M for Minimization and –M for Maximization.
	5. Use as Initial Program Variable	Used as Starting Point (Initial Table).	Cannot be used since Unit Matrix condition is not satisfied.	Initially used but later eliminated.
	6. Presence in the Optimal Table	Helps to interpret Idle & Key Resources.	–	Indicates "No Feasible Solution."
Primal vs Dual	For any LPP Model called the **Primal** Model, there exists a companion model called the **Dual Model**. The relationship between Primal and Dual LPP are – • The **Objective** of the Dual will be the **opposite** of the Primal. • **Constraints** in Dual LPP will be in tune with the Dual's Objective, e.g. Max Obj with '≤' constraints. • The **Dual of the Dual** problem is the Primal problem itself. • If Primal has "m" Variables and "n" Constraints, then Dual has "n" Variables and "m" Constraints. • Objective Functions of the Optimal Tables of Primal and Dual will have identical values. [**Note: NER** of Optimal Table of Primal LPP will be reflected in the **Quantity Column** of Optimal Table of Dual LPP, and vice–versa.] • If the Primal LPP has no optimal solution because of infeasibility, then the Dual LPP will also have no optimal solution because of unboundedness, and vice–versa.			

	• Feasible Solutions to the Primal and Dual Problem are both optimal, if the complementary slackness conditions hold, i.e. – • (Value of a Primal Variable) × (Value of the corresponding Dual Surplus Variable) = 0, or • (Value of a Primal Slack Variable) × (Value of the corresponding Dual Variable) = 0 **Note:** When this relationship does not exist, then either primal or dual solution or both are non–optimal.

Steps in Simplex Method

Step 1: Objective: Determine the Objective Function (denoted by Z). [either Maximisation or Minimisation]

Step 2: Constraints: List the Constraints applicable for the objective. For Maximisation Objective, atleast one Constraint should bear ≤ sign. For Minimisation Objective, atleast one Constraint should bear ≥ sign.

Step 3: Conversion of Inequalities into Equalities: Convert Inequalities into Equalities as below:

Nature of Inequality	Introduce	Co–efficient of such Variable in the Objective Function
≤	A **Slack** Variable	Zero for all Slack Variables
≥	A **Surplus** Variable and **Artificial** Variable	Zero for all Surplus Variables +M, for all Artificial Variables in case of Minimisation Objective – M, for all Artificial Variables in case of Maximisation Objective

Step 4: Revised Objective: Re–draft the Objective Function by including the variables in this order – (a) Regular Variables as given in the objective, (b) Slack Variables with Zero Co–efficient, (c) Surplus Variables with Zero Co–efficient, and (d) Artificial Variables with + M Co–efficient (depending upon the Objective) [**Note: M = Infinity Cost.**]

Step 5: Initial Simplex Table: The format of the Simplex Table is as under –

Fixed Ratio	Program	Profit/Cost	Quantity	Variables Columns				Replacement Ratio (RR)
				A	B	S_1	S_2	
	Row 1							
	Row 2, etc.							
			Z (= Objective Value)					
			C (= Computed Value)					
			NER (Net Evaluation Row) = Z – C					

(a) Select Slack Variables as **Initial Program** for Maximisation Objective. In case of Minimisation Objective, Slack and Artificial Variables constitute the Initial Program, forming a Unit Matrix of Co–efficients.

(b) Fill up Profit/ Cost of the Program Variables as per Objective Function.

(c) Fill up Quantity = RHS of Constraints.

(d) Fill up Co–efficients of various variables as per the Constraints, in the respective columns.

(e) Fill up Z Row (i.e. Objective Value) against each Variable, as per Objective Function.

(f) Compute C = Profit × Co–efficient of each Variable.

(g) Compute Net Evaluation Row (NER) = Z – C.

(h) Select **maximum positive** NER (Z – C) for Maximisation Objective and circle **Key Column**. Corresponding Variable is called as the Incoming Variable. In case of Minimisation Objective, select **worst negative** NER (Z – C).

(i) Compute Replacement Ratio (RR) = $\frac{\text{Quantity}}{\text{Key Column Element}}$.

(j) Select **minimum non–negative** Replacement Ratio (RR) and **Circle Key Row**. In case RR = 0, it shall be selected as minimum non–negative. In case of tie in RR, arbitrary selection can be made.

(k) Identify **Pivot Element**, i.e. Junction of Key Row and Key Column.

(l) Compute **Fixed Ratio** (FR) for **Non–Key Rows** = $\frac{\text{Key Column Element}}{\text{Pivot Element}}$. For Key Row, FR is Not Applicable.

(m) Determine Replacement Decision: (a) Incoming Variable = Key Column, and (b) Outgoing Variable = Key Row.

Step 6: Second and Subsequent Table:

(a) Fill up Program Variables by Replacement Decision as per earlier Table.

(b) Fill up Profit / Cost of the program variables based on Objective Function.

(c) Update **Key Row** by the Transformation Rule = $\frac{\text{Previous Table Key Row Element}}{\text{Pivot Element}}$.

(d) Update **Non–Key Rows** by the Transformation Rule = (Previous Table Corresponding Row Element) **Less** (Key Row Element × Fixed Ratio)

(e) Fill up Z Row (i.e. Objective Value) against each Variable, as per Objective Function.

(f) Compute C = Profit × Co–efficient of each Variable.

(g) Compute Net Evaluation Row (NER) = Z – C.

(h) Repeat the selection and rea–llocation procedure [Step (h) to (m) as given above] till all Z – C ≤ 0 for Maximization Objective, and all Z – C ≥ 0 for Minimisation Objective.

Note/ Check Points:

- Program Elements always form a **Unit Matrix**, but need not be adjacent.
- In every Table for all Program Variables, NER = Z – C = "0" (Zero)
- Retain fractions in all computations.

Procedure for Minimisation Objective:

(a) Introducing Surplus Variables, the constraint functions are to be re–written and converted into equalities.

(b) However, since Surplus Variables when introduced as Initial Program, violate the non–negativity assumption, Artificial Variables "M" of heavy cost (close to infinity) are introduced and the constraints and objective functions are re–written.

(c) Initial Program is commenced using Artificial Variables only (since it satisfies the unit matrix condition).

(d) An Artificial Variable once eliminated (i.e. selected as Key Row) will be removed, and will not re–enter the Simplex Table in the subsequent iterations.

(e) If Artificial Variable exists in the "Optimal Table", the solution is not optimal. There is no feasible solution in that case.

Special Cases and Treatment

Situation	Treatment
Degeneracy	• It occurs if there is a tie in the **minimum non–negative Replacement Ratio**. • In case of Degeneracy, the Outgoing Variable (Key Row) should be selected on an arbitrary basis. • The Variable not selected as Outgoing, will bear "0"(Zero) in the Quantity Column in the next Table. (**Note:** This zero need not continue till the Optimal Table)
Equality Constraints	• The given Equality Constraint is split into **two** inequalities in opposite directions, '≤' and '≥' signs. • The regular procedure like introduction of Slack, Surplus and Artificial Variables will be adopted thereafter. [**Note:** Alternatively, an Artificial Variable can be introduced in an equality constraint.]
Multiple Optimal Solutions	• For any Optimal Solution, NER = Z – C = 0 for all Program Variables (i.e. Basic Variables). • LPP has alternative solution(s) if in the Optimal Table, a **Non–Program Variable** has NER = 0. • The Alternative Solution(s) can be obtained by identifying such Non–Program Variable (bearing NER = 0) as the Incoming Variable.(i.e. Key Column)
No Feasible solution	• Artificial Variable, once eliminated, should not re–enter subsequent iterations (tables). • If Artificial Variable exists in the "Optimal Table", the solution is not optimal. There is **no feasible solution** in that case.
Unbounded Solution	• Outgoing Variable is selected on the basis of minimum non–negative Replacement Ratio. • If **all** Replacement Ratios are **negative**, the Outgoing Variable cannot be identified. • The LPP is said to have **unbounded solution** in such cases, when all RR are negative.

Interpretation of existence of Slack Variables in the Optimal Table of a maximization LPP

Nature of Slack	Nature of NER	Nature of Resource	Interpretation / Remarks
Non–Program Variable	NER < 0 (i.e. negative)	Key Resource	This means that for every reduction in the RHS of that Constraint, the Profit will be reduced by the NER. Thus, the value of NER represents the **Contribution Loss per unit** of RHS of that Constraint / Key Resource. [**Note:** This Contribution Loss is also called **Shadow Price** (or) Marginal Value of that Resource.]
Program Variable	NER = 0	Idle Resource	This means that the Resource has no Contribution Loss, and is hence not fully utilized. The extent of Slackness / Idleness / Unused Resources is equal to the "Quantity Column" of the concerned Program Slack Variable.

Interpretation of Peculiarities in the Graph (Note: Number of Variables = 2 only)

1. Degeneracy	The feasible region may be defined by a **single point** which satisfies all conditions.
2. No Feasible Solution	There is **no feasible region** which satisfies all the constraints given in the LPP.
3. Unbounded Solution	The Feasible Region is **not finite**. The upper bound (in case of Maximisation LPP) or the lower bound (in case of Minimisation LPP) is not identifiable.
4. Multiple Optimal Solution(s)	The Iso–Profit (or Iso–Cost) Line has the same Slope as that of a Constraint, i.e. the Objective Function and any one of the Constraints have the same Slope. [**Note: Slope** = Ratio of Co–efficient of the Variables.]

FTR 19 Network Analysis

Issue	Points to remember	Page
Project	• Project = Set of Activities and Events that are performed in a certain sequence, to achieve specific objective(s). • Each of the activities requires **time**, consumes other **resources**, and involves **cost**. • Features: (1) Objective, (2) Activity Sequence, (3) Scale, (4) Time, (5) Cost, (6) Uncertainty.	19.1
Steps in Network Analysis	1. Analyse and break down the Project in terms of specific activities and / or events. 2. Determine inter–dependence and sequence of specific activities, & prepare Network Diagram. 3. Assign estimates of time, cost or both to all the activities of the Network. 4. Identify the longest or critical path through the Network. 5. Monitor, evaluate and control the progress by re–planning, re–scheduling and re–assignment of resources.	19.1
Critical Path	1. **Critical Path** = Longest Path through the Network. The length of the Critical Path determines the **minimum duration** in which the Project can be completed. 2. **Importance:** (a) Start and Finish Times, (b) Activities for Crashing, (c) Activity Monitoring, and (d) Resource Allocation and Smoothing. 3. **Advantages:** (a) Comprehensive view, (b) Better Control, (c) Management by Exception, and (d) Dynamism.	19.1, 19.3
Network Diagram	1. Network Diagram is a graphical representation of a Project, depicting the flow as well as the sequence of well–defined activities and events, and their inter–relationships. 2. When arrows in a Network Diagram are drawn to a time scale (i.e. proportional to the duration), it is called as a **Time–Scaled Diagram.** 3. Common Errors in a Network Diagram are – (a) Looping, (b) Dangling, and (c) Duplication.	19.3, 19.4
Activity	Portion of a Project / Network, which consumes time or resources and has a definite beginning and ending. Activities are jobs are denoted by Arrows in the Diagram.	19.3
Events	• Events are the beginning and ending points of an activity or a group of activities. • Activities in a Network must commence from some event called **Tail Events.** (LHS = Tail) • Activities in a Network must have terminal points called the **Head Event.** (RHS = Head) • **Merge Events:** Represents the **joint completion** of more than one activity. • **Burst Events:** Represents the **joint initiation / commencement** of more than one activity.	19.3
Forward and Backward Pass Compu–tations	**Forward Pass Computations** • For the Initial (i.e. Starting) Event, E = 0 (zero). • For any subsequent Event, E = E of Tail Event (LHS Event) + Activity Duration. • In case of Merge Event on the Forward Pass, highest (i.e. maximum) "E" shall be considered. **Backward Pass Computations** • For the Terminal (i.e. Last) Event, L = E as per Forward Pass. • For any Preceding Event, L = E of Head Event (RHS Event) + Activity Duration. • In case of Burst Event on the Backward Pass, least "L" shall be considered.	19.4
Dummy Activity	Hypothetical Activity, which consumes no resources and time, and involves no cost. It is represented by dotted lines in the Network Diagram. Purposes of Dummy Activity are – • To make activities with common starting and finishing events distinguishable, • To identify and maintain precedence rel'ship bet'n activities which are not connected, • To clarify the relationship bet'n dependent and independent activities, • To avoid "dangling" or unconnected events in the network.	19.5