

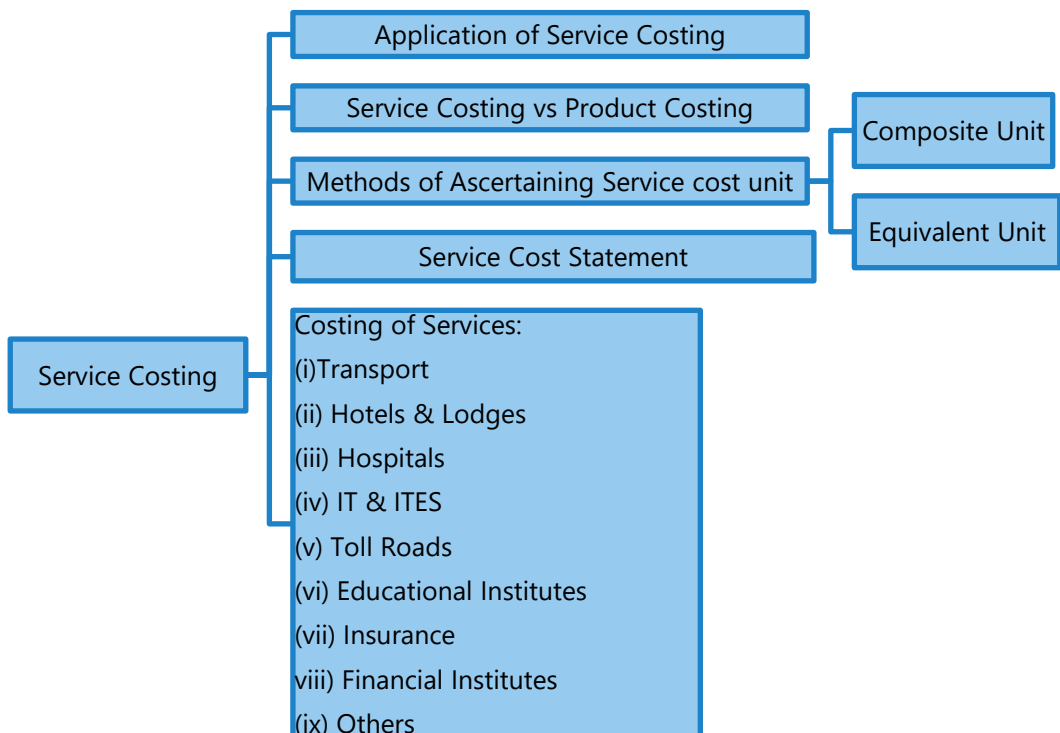
SERVICE COSTING



LEARNING OUTCOMES

- ◆ Discuss the cost accounting method for service sectors.
- ◆ State the units used in different service sectors.
- ◆ State the KPIs used in different service sectors.
- ◆ Calculate the costs for different service industries.

CHAPTER OVERVIEW



1. INTRODUCTION

Service sector, being a fastest growing sector and having a significant contribution towards the GDP in India, is a very important sector where the role of the cost and management accounting is inevitable. The competitiveness of a service entity is very much dependent on a robust cost and management accounting system for competitive pricing and identification of value adding activities. Providers of services like transportation, hotels, financial services & banking, insurance, electricity generation, transmission and distribution etc. are very much cost conscious and thrive to provide services in a cost-effective manner. Irrespective of regulatory requirements to maintain cost records and get the records audited, service costing becomes integral and inseparable part of each service entity. In this chapter we will be discussing how costing is done in service sectors like Transportation, Toll roads, Electricity generation, transmission and distribution, Hospitals, Canteen & Restaurants, Hotels & Lodges, Educational institutes, Financial institutions, Insurance, Information Technology (IT) & Information Technology Enabled Services (ITES) etc.

Service costing is also known as operating costing.

1.1 Application of Service Costing

Internal: The service costing is required for in-house services provided by a service cost centre to other responsibility centres as support services. Examples of support services are Canteen and hospital for staff, Boiler house for supplying steam to production departments, Captive Power generation unit, operation of fleet of vehicles for transport of raw material to factory or distribution of finished goods to the market outlets, IT department services used by other departments, research & development, quality assurance, laboratory etc.

External: When services are offered to outside customers as a profit centre in consonance with organisational objectives as an output like goods or passenger transport service provided by a transporter, hospitality services provided by a hotel, provision of services by financial institutions, insurance and IT companies etc.

In both the situation, all costs incurred are collected, accumulated for a certain period or volume, recorded in the cost accounting system and then expressed in terms of a cost unit of service.

1.2 Service Costing vs Product Costing

Service costing differs from product costing (such as job or process costing) in the following ways due to some basic and peculiar nature.

- (i) **Tangibility:** Unlike products, services are intangible and cannot be stored, hence, there is no inventory for the services.
- (ii) **Cost units:** Use of Composite cost units for cost measurement and to express the volume of outputs.
- (iii) **Material vs Employee cost:** Unlike a product manufacturing, employee (labour) cost constitutes a major cost element than material cost.
- (iv) **Traceability of costs:** Indirect costs like administration overheads are generally have a significant proportion in total cost of a service as unlike manufacturing sector, service sector heavily depends on support services and traceability of costs to a service may not economically feasible.



2. SERVICE COST UNIT AND KPI

To compute the Service cost, it is necessary to understand the unit for which the cost is to be computed. All the costs incurred during a period are collected and analyzed and then expressed in terms of a cost per unit of service.

One specific issue with service costing is the difficulty in defining a realistic cost unit that represents a suitable measure of the service provided. The cost unit to be applied needs to be defined carefully and frequently, a composite cost unit may be deemed more appropriate.

For example, Hotels may use the 'Occupied Room Days' as an appropriate unit for cost ascertainment and control.

Other typical cost unit that may be used include:

Service industry	Unit of cost (examples)
Transport Services	Passenger- km., (In public transportation) Quintal- km., or Tonne- km. (In goods carriage)
Electricity Supply service	Kilowatt- hour (kWh)

Hospital	Patient per day, room per day or per bed, per operation etc.
Canteen	Per item, per meal etc.
Cinema	Per ticket.
Hotels	Guest Days or Room Days
Bank or Financial Institutions	Per transaction, per services (e.g. per letter of credit, per application, per project etc.)
Educational Institutes	Per course, per student, per batch, per lecture etc.
IT & ITES	Cost per project, per module etc.
Insurance	Per policy, Per claim, Per TPA etc.

The costing should be comprehensive enough to show the effects like off-season and peak-season demand, full time, part time, etc.

Key Performance Indicator (KPI)

Key Performance Indicators (KPIs) are the quantitative and qualitative factors which are commonly used to assess the performance of an organization which are important to achieve its goal. Like calculation of cost for a cost unit, calculation of cost or revenue per KPI helps to the performance against industry standards. For example, in case of Telecom industry Average Return per User (ARPU) is a key indicator, shows average revenue generated from a user of its services. The list below shows few important KPIs for some Service Industries:

Industry	KPI	Meaning
Transportation	Number of Shipments,	This logistics metric monitors the number of orders that are shipped out of the warehouse.
	Truck Turnaround Rate (Truck Turning),	The time from when a delivery truck enters the warehouse to collect or deliver products to when it exits the facility.
	Lead Time (Order Cycle Time)	The amount of time in between order placement by customer and receipt of order.

	On-Time and In-Full (OTIF)	The number of orders delivered according to the schedule and quantity specified.
Hotel Industry	Cost per Occupied Room (CPOR)	The average cost per occupied room.
	Occupancy Rate	The ratio of rented or used rooms to the total amount of available rooms.
	Revenue per available room (RevPAR)	The average revenue per available room days.
Hospitals/ Health care Industry	Bed Occupancy Rate	The proportion of hospital beds in use at any one time.
	Staff-To-Patient Ratio	The number of staff resources present to attend to the patients in a hospital over a certain period of time.
	Average Treatment Charge	The average amount that a facility charges a patient for a treatment.
IT & ITES sector	Gross Burn Rate	The rate at which the company uses up its available cash to cover operating expenses.
	Customer Acquisition Cost (CAC)	The amount it takes to attract new customers.
	Customer Lifetime Value (CLV)	The typical net profit a company generates over the entire life cycle of a single customer.
	Monthly Recurring Revenue (MRR)	The amount earned each month through subscription renewals, new sales, upsells, and fluctuations on a monthly basis.
	Churn Rate	The percentage of customers that cancel their recurring subscriptions over a given time period.
	Cost Per Feature	How much a specific feature costs your business, based on usage and cloud costs.

Telecom	Average return per user (ARPU)	How much money a company is making for each person using its service.
	Subscriber acquisition cost (SAC)	Costs involved with gaining new subscribers.
	Network Operating Cost	Expenditure incurred on continual upkeep to telecom's network.
	Gross Revenue Retention (GRR)	How well a company is retaining its customers based on factors such as sales price increases, organic customer growth, and more.
Education Sector	Instructional Costs	The cost of part-time and full-time faculty members
	Administrative Costs Per Student.	How much an institution is spending on administrative services on a per-student basis.
	Tuition Costs	Costs accrued by students on a semester or annual basis.
	Student-to-Faculty Ratio	The number of students per faculty member, on a campus-wide basis or by department.
Insurance Sector	Average Cost Per Claim	The average cost of each claim made.
	Components of Claim Costs (CCC)	Costs which are associated with a claim like legal fees, time to settle, administration costs, and report delays.
	Cost Per Quote	The costs that the company incurs in order to get a quote in front of a potential client.
	Administrative Costs Per Policy	The cost of the policy administration to number of policies outstanding.
	Average Policy Size	The total amount of premium collected by the number of policies issued for a given time period.

2.1 Methods for ascertaining Service Cost Unit

Composite Cost Unit

Sometime two measurement units are combined together to know the cost of service or operation. These are called composite cost units. For example, a public transportation undertaking would measure the operating cost per passenger per kilometer.

Examples of Composite units are Tonne- km., Quintal- km, Passenger-km., Patient-day etc. **Composite unit may be computed in two ways.**

- (i) Absolute (Weighted Average) basis.
- (ii) Commercial (Simple Average) basis.

In both bases of computation of service cost unit, weightage is also given to qualitative factors rather quantitative (which are directly related with variable cost elements) factors alone.

(i) Weighted Average or Absolute basis – It is a summation of the products of qualitative and quantitative factors. For example, to calculate absolute Tonne-Km for a goods transport is calculated as follows.:

$$\frac{\sum(\text{Weight Carried} \times \text{Distance})_1 + (\text{Weight Carried} \times \text{Distance})_2 + \dots + (\text{Weight Carried} \times \text{Distance})_n}{n}$$

Similarly, in case of Cinema theatres, price for various classes of seats is fixed differently. For example–

First class seat may be provided with higher quality service and hence charged at a higher rate, whereas Second Class seat may be priced less. In this case, appropriate weight to be given effect for First Class seat and Second Class seat – to ensure proper cost per composite unit.

(ii) Simple Average or Commercial Basis – It is the product of average qualitative and total quantitative factors. For example, in case of goods transport, Commercial Tonne-Km is arrived at by multiplying total distance km., by average load quantity.

$$\sum(\text{Distance}_1 + \text{Distance}_2 + \dots + \text{Distance}_n) \times \left(\frac{W_1 + W_2 + \dots + W_n}{n} \right)$$

In both the example, variable cost is dependent of distance and is a quantitative factor. Since, the weight carried does not affect the variable cost hence and is a qualitative factor.

To understand the concept of absolute tonne-km., and commercial tonne-km., the following illustration may be referred.

ILLUSTRATION 1

A lorry starts with a load of 20 MT of goods from Station 'A'. It unloads 8 MT in Station 'B' and balance goods in Station 'C'. On return trip, it reaches Station 'A' with a load of 16 MT, loaded at Station 'C'. The distance between A to B, B to C and C to A are 80 Kms, 120 Kms and 160 Kms, respectively. COMPUTE "Absolute MT-Kilometer" and "Commercial MT – Kilometer".

(MT = Metric Ton or Ton).

SOLUTION

Weighted Average or Absolute basis – MT – Kilometer:

$$\begin{aligned} &= (20 \text{ MT} \times 80 \text{ Kms}) + (12 \text{ MT} \times 120 \text{ Kms}) + (16 \text{ MT} \times 160 \text{ Kms}) \\ &= 1,600 + 1,440 + 2,560 = 5,600 \text{ MT - Kilometer} \end{aligned}$$

Simple Average or Commercial basis – MT – Kilometer:

$$\begin{aligned} &= \left\{ \frac{(20+12+16)}{3} \right\} \text{ MT} \times \{(80+120+160) \text{ Kms}\} \\ &= 16 \text{ MT} \times 360 \text{ Kms} = 5,760 \text{ MT – Kilometer} \end{aligned}$$

Equivalent Cost Unit/ Equivalent Service Unit:

To calculate cost or pricing of two more different grade of services which uses common resources, **each grade of service is assigned a weight and converted into equivalent units**. Converting services into equivalent units make different grade of services equivalent and comparable.

For Example:

A hotel has three types of suites for its customers, viz., Standard, Deluxe and Luxurious.

Following information is given:

Type of suite	Number of rooms	Room Tariff
Standard	100	--
Deluxe	50	2.5 times of the Standard suites
Luxurious	30	Twice of the Deluxe suites

The rent of Deluxe suite is to be fixed at 2.5 times of the Standard suite and that of Luxurious suite as twice of the Deluxe suite.

Since, all three types of suites use same amount of overheads, but to attach qualitative weight, these rooms are required to be converted into equivalent units. This can be done in two ways

(i) Making all suites equivalent to Standard suites:

Nature of suite	Occupancy (Room-days)	Equivalent single room suites (Room-days)
Standard	36,000 (100 rooms × 360 days)	36,000 (36,000 × 1)
Deluxe	18,000 (50 rooms × 360 days)	45,000 (18,000 × 2.5)
Luxurious	10,800 (30 rooms × 360 days)	54,000 (10,800 × 5)
		1,35,000

Or

(ii) Making all suites equivalent to Luxurious suites:

Nature of suite	Occupancy (Room-days)	Equivalent Luxurious suites (Room-days)
Standard	36,000 (100 rooms × 360 days)	7,200 (36,000 × 1/5)
Deluxe	18,000 (50 rooms × 360 days)	9,000 (18,000 × 1/2)

Luxurious	10,800 (30 rooms × 360 days)	10,800 (10,800 × 1)
		27,000



3. STATEMENT OF COSTS FOR SERVICE SECTORS

For preparing a statement of cost or a cost sheet for service sector, costs are usually collected and accumulated for a specified period viz. A month, quarter or a year, etc.

The cost statement for services may be prepared either on the basis of functional classification as done for product costing or on the basis of variability. Cost sheet on the basis of variability is prepared classifying all the costs into three different heads:

1. Fixed costs or Standing charges
2. Variable costs or Operating expenses
3. Semi-variable costs or Maintenance expenses

Note: In the absence of information about semi-variable costs, the costs would be shown under fixed and variable heads only.

Treatment of Depreciation- Fixed or Variable?

If related to effluxion of time or calculated on time basis, will be treated as fixed. However, if the depreciation is calculated on the basis of activity level or usage, it will be treated as variable cost.

Treatment of Interest

Interest and finance charges shall be presented in the cost statement as a separate item of cost of sales. In general, interest is treated as fixed cost, unless otherwise given.

4. APPLICATIONS OF COSTING METHODS IN SERVICE COSTING

Costing techniques vis-a vis Service sector: So far in previous chapters we have learnt how to collect, accumulate and calculate cost for each cost elements like Material, Employee (labour), Direct expenses and Overheads. We also learnt the various methods of costing like Job & Contract costing, Process & operation costing, Joint products & By products costing. Then again Cost Management techniques like Standard Costing, Budget and budgetary control Marginal costing are also equally applied in service sector.

In general, the service sectors are either labour or capital intensive or both, that is the reason the proportion of costs of cost elements differs from manufacturing sectors. A manufacturing sector may have higher material cost than the labour, but in case of service sector the situation reverses.

The system and techniques for cost collection, accumulation and valuation is similar as that has been learnt in previous chapters for each cost elements. The overhead allocation, apportionment and absorption techniques are also very similar.

Method of costing vis-à-vis Service sector: The choice of method of costing depends on nature of service provided. For example, Job costing method may be suitable for a business which is engaged in development of customized software, healthcare etc. Process costing may be suitable for utility business like power, water supplies etc., Joint products costing may be suitable for businesses which are providing bundled service like telecom, event management, educational institutes etc.

5. COSTING OF TRANSPORT SERVICES

Transport organizations can be divided into two categories viz. Goods transport and Passenger transport.

The cost unit for Goods transport organization is Tonne– Kilometer – that means cost of carrying one Tonne of goods over a distance of one kilometer.

Cost unit for Passenger transport organization is Passenger– Kilometer – that means cost of carrying one Passenger over a distance of one kilometer.

The costs are shown under the suggestive following heads:

(i) Standing Charges or Fixed costs: These are the fixed costs that remain constant irrespective of the distance travelled. These costs include the following:

- Insurance
- License fees
- Salary to Driver, Conductor, Cleaners, etc if paid on monthly basis
- Garage costs, including garage rent
- Depreciation (if related to efflux of time)
- Taxes
- Administration expenses, etc.

(ii) Variable costs or Running costs: These costs are generally associated with the distance travelled. These costs include the following:

- Petrol and Diesel
- Lubricant oils,
- Wages to Driver, Conductor, Cleaners, etc. if it is related to operations
- Depreciation (if related to activity)
- Any other variable costs identified.

(iii) Semi-Variable Costs or Maintenance Costs: These costs include the following:

- Repairs and maintenance
- Tyres
- Spares, etc.

The heads for a cost may change as per the situation or condition. For an example salary of driver may be treated as standing charges or running cost depending on the situation and nature of his employment.

ILLUSTRATION 2

AXA Passenger Transport Company is running 5 buses between two towns, which are 40 kms apart. Seating capacity of each bus is 40 passengers. Following details are available from their books, for the month of April:

Particulars	Amount (₹)
Salary of Drivers, Cleaners and Conductors	24,000
Salary to Supervisor	10,000
Diesel and other Oil	40,000
Repairs and Maintenance	8,000
Tax and Insurance	16,000
Depreciation	26,000
Interest	20,000
	1,44,000

Actual passengers carried were 75% of the seating capacity. All the five buses run on all days for the month. Each bus made one round trip per day. CALCULATE cost per passenger – Kilometer.

SOLUTION**Working Note:**

Total Passenger Kilometres =

Number of Buses × Distance × Seating Capacity × Used Capacity × Number of days in the month × Number of trips

= 5 Buses × 40 kms. × 40 Seats × 75% × 30 Days × 2 Single trips (1 Round Trip)

= 3,60,000 Passenger-Kms.

Cost per Passenger-Km = Total costs ÷ Total Passenger Kilometers

Statement of Cost per Passenger – Km

Particulars	Cost Per Month	Cost per Passenger – Km
A. Standing Charges:		
Wages of Drivers, Cleaners and Conductors	24,000	
Salary to Supervisor	10,000	
Tax and Insurance	16,000	
Depreciation	26,000	
Interest	20,000	
Total Standing Charges	96,000	0.267
B. Running Charges		
Diesel and other Oil	40,000	0.111
C. Maintenance Charges		
Repairs and Maintenance	8,000	0.022
Total	1,44,000	0.400

Cost per Passenger-Km = ₹ 0.40

ILLUSTRATION 3

ABC Transport Company has given a route 40 kilometers long to run bus.

- The bus costs the company a sum of ₹ 10,00,000
- It has been insured at 3% p.a. and
- The annual tax will amount to ₹ 20,000
- Garage rent is ₹ 20,000 per month.
- Annual repairs will be ₹ 2,04,000
- The bus is likely to last for 2.5 years
- The driver's salary will be ₹ 30,000 per month and the conductor's salary will be ₹ 25,000 per month in addition to 10% of takings as commission [To be shared by the driver and conductor equally].

- (h) Cost of stationery will be ₹ 1,000 per month.
- (i) Manager-cum-accountant's salary is ₹ 17,000 per month.
- (j) Petrol and oil will be ₹ 500 per 100 kilometers.
- (k) The bus will make 3 up and down trips carrying on an average 40 passengers on each trip.
- (l) The bus will run on an average 25 days in a month.

Assuming 15% profit on takings, CALCULATE the bus fare to be charged per passenger-kilometer.

SOLUTION

Working Note:

(1) Total Kilometers run per annum:

= Number of Buses × Distance × Number of days in the Month × Number of trips × 12 months

= 1 Bus × 40 kms × 25 Days × 6 Single trips (3 Round Trips) × 12 months = 72,000 kms.

(2) Total Passenger Kilometers per annum:

Total Kilometers run per annum × Seating Capacity

= 72,000 Kms × 40 Seats = 28,80,000 Passenger-Kms.

(3) Petrol & oil Consumption per annum:

Total Kilometers run per annum × Petrol Consumption per KM

= 72,000 Kms × (₹500 / 100 Kms) = ₹ 3,60,000

Statement of Cost per Passenger – Km

Particulars	Per Annum	Per Passenger - Kilometer
A. Standing Charges:		
Insurance @ 3% on ₹10,00,000	30,000	
Annual Tax	20,000	
Garage rent (₹20,000 × 12)	2,40,000	

Depreciation	4,00,000	
Salary of Driver (fixed part)	3,60,000	
Salary of Conductor (fixed part)	3,00,000	
Stationary	12,000	
Manager-cum-accountant's salary	2,04,000	
Total Standing Charges	15,66,000	0.5438
B. Running Charges:		
Diesel and other Oil (WN-3)	3,60,000	
Commission to Driver* (10% × ₹28,40,000 × 1/2)	1,42,000	
Commission to Conductor* (10% × ₹28,40,000 × 1/2)	1,42,000	
Total Running Charges	6,44,000	0.2236
C. Maintenance Charges:		
Repairs	2,04,000	0.0708
Grand Total (A+B+C)	24,14,000	0.8382
Profit (15% × ₹28,40,000)	4,26,000	0.1479
Fare per Passenger Kilometer		0.9861

*Total takings = Standing Charges + (Running cost + Commission on takings)

+ Maintenance cost + Profit

Let Takings = X

Or, $X = 15,66,000 + (3,60,000 + 0.1X) + 2,04,000 + 0.15X$

Or, $X - 0.25X = 21,30,000$

Or, $X = 28,40,000$

ILLUSTRATION 4

SMC is a public school having five buses each plying in different directions for the transport of its school students. In view of a larger number of students availing of the bus service the buses work two shifts daily both in the morning and in the afternoon. The buses are garaged in the school. The work-load of the students has been so arranged that in the morning the first trip picks up senior students and the second trip plying an

hour later picks up the junior students. Similarly, in the afternoon the first trip takes the junior students and an hour later the second trip takes the senior students' home.

The distance travelled by each bus one way is 8 km. The school works 25 days in a month and remains closed for vacation in May, June and December. Bus fee, however, is payable by the students for all 12 months in a year.

The details of expenses for a year are as under:

Driver's salary	₹4,500 per month per driver
Cleaner's salary	₹3,500 per month
(Salary payable for all 12 months)	
(One cleaner employed for all the five buses)	
License fee, taxes, etc.	₹8,600 per bus per annum
Insurance	₹10,000 per bus per annum
Repairs & maintenance	₹35,000 per bus per annum
Purchase price of the bus	₹15,00,000 each
Life of each bus	12 years
Scrap value of buses at the end of life	₹3,00,000
Diesel cost	₹45.00 per litre

Each bus gives an average mileage of 4 km. per litre of diesel.

Seating capacity of each bus is 50 students.

The seating capacity is fully occupied during the whole year.

Students picked up and dropped within a range up to 4 km. of distance from the school are charged half fare and fifty per cent of the students travelling in each trip are in this category. Ignore interest. Since the charges are to be based on average cost you are required to:

- (i) PREPARE a statement showing the expenses of operating a single bus and the fleet of five buses for a year.
- (ii) WORK OUT the average cost per student per month in respect of –
 - (A) students coming from a distance of upto 4 km. from the school and
 - (B) students coming from a distance beyond 4 km. from the school.

SOLUTION**(i) Statement of Expenses of operating bus/ buses for a year**

Particulars	Rate (₹)	Per Bus per annum (₹)	Fleet of 5 buses p.a. (₹)
(i) Standing Charges:			
Driver's salary	4,500 p.m	54,000	2,70,000
Cleaner's salary	3,500 p.m	8,400	42,000
Licence fee, taxes etc.	8,600 p.a.	8,600	43,000
Insurance	10,000 p.a.	10,000	50,000
Depreciation (15,00,000 – 3,00,000) ÷ 12 yrs	1,00,000 p.a.	1,00,000	5,00,000
(ii) Maintenance Charges:			
Repairs & maintenance	35,000 p.a.	35,000	1,75,000
(iii) Operating Charges:			
Diesel (Working Note 1)		1,62,000	8,10,000
Total Cost [(i) + (ii) + (iii)]		3,78,000	18,90,000
Cost per month		31,500	1,57,500
Total no. of equivalent students		150	750
Total Cost per half fare equivalent student		₹ 210	₹ 210

(ii) Average cost per student per month:**A. Students coming from distance of upto 4 km. from school**

$$= \frac{\text{Total cost per month}}{\text{Total no. of equivalent students}} = \frac{₹ 31,500}{150 \text{ students}} = ₹ 210$$

B. Students coming from a distance beyond 4 km. from school

$$= \text{Cost of per half fare student} \times 2 = ₹ 210 \times 2 = ₹ 420$$

Working Notes:**1. Calculation of Diesel cost per bus :**

Distance travelled in a year:

(8 round trip × 8 km. × 25 days × 9 months)

Distance travelled p.a.: 14,400 km.

Cost of diesel (per bus p.a.): $\frac{14,400\text{km.}}{4\text{kmpl}} \times ₹ 45 = ₹ 1,62,000$

2. Calculation of equivalent number of students per bus :

Seating capacity of a bus	50 students
Half fare students (50% of 50 students)	25 students
Full fare students (50% of 50 students)	25 students

Total number of students equivalent to half fare students

Full fare students (25 students × 2)	50 students
Add: Half fare students	25 students
Total Equivalent number of students in a trip	<u>75 students</u>
Total number of equivalent students in two trips (Senior + Junior)	<u>150 students</u>

ILLUSTRATION 5

GTC has a lorry of 6-tonne carrying capacity. It operates lorry service from city A to city B for a particular vendor. It charges ₹ 2,400 per tonne from city 'A' to city 'B' and ₹ 2,200 per tonne for the return journey from city 'B' to city 'A'. Goods are also delivered to an intermediate city 'C' but no extra charges are billed for unloading goods in-between destination city and no concession in rates is given for reduced load after unloading at intermediate city. Distance between the city 'A' to 'B' is 300 km and distance from city 'A' to 'C' is 140 km.

In the month of January, the truck made 12 journeys between city 'A' and city 'B'. The details of journeys are as follows:

Outward journey	No. of journeys	Load (in tonne)
'A' to 'B'	10	6
'A' to 'C'	2	6
'C' to 'B'	2	4
Return journey	No. of journeys	Load (in tonne)
'B' to 'A'	5	8
'B' to 'A'	6	6
'B' to 'C'	1	6
'C' to 'A'	1	0

Annual fixed costs and maintenance charges are ₹6,00,000 and ₹1,20,000 respectively. Running charges spent during the month of January are ₹2,94,400 (includes ₹12,400 paid as penalty for overloading).

You are required to:

- (i) CALCULATE the cost as per (a) Commercial tonne-kilometer. (b) Absolute tonne-kilometer.
- (ii) CALCULATE Net Profit/ loss for the month of January.

SOLUTION

(i) **Calculation of total monthly cost for running truck:**

	Particulars	Amount per annum (₹)	Amount per month (₹)
(i)	Standing Charges:		
	Annual fixed costs	6,00,000	50,000
(ii)	Maintenance Charges:	1,20,000	10,000
(iii)	Running Cost:		
	Running charges	2,94,400	
Less:	Penalty paid for overloading (12,400)		2,82,000
	Total monthly cost		3,42,000

$$(a) \text{ Cost per commercial tonne-km.} = \frac{\text{₹}3,42,000}{44,856 \text{ ton-km.}} = \text{₹} 7.62$$

(Refer to working note-1)

$$(b) \text{ Cost per absolute tonne-km.} = \frac{\text{₹}3,42,000}{44,720 \text{ ton-km.}} = \text{₹} 7.65$$

(Refer to working note-2)

(ii) **Calculation of Net Profit/Loss for the month of January:**

Particulars	(₹)	(₹)
Truck hire charges received during the month:		
From Outward journey [(10 + 2) trips × 6 tonne × ₹ 2,400]	1,72,800	
From return journey {(5 trips × 8 tonne × ₹ 2,200) + [(6 + 1) trips × 6 tonne × ₹ 2,200]}	1,80,400	3,53,200
Less: Monthly running cost {as per (i) above}		(3,42,000)
<i>Operating profit</i>		11,200
Less: Penalty paid for overloading		(12,400)
Net Loss for the month		(1,200)

Working Notes:

1. Calculation of Commercial Tonne-km:

Particulars		Tonne-km.
A. Total Distance travelled		
To and fro (300 km × 2 × 12 trips) (in km)		7,200
B. Average weight carried:		
Outward (12 journeys × 6 tonne + 2 journeys × 4 tonne)	80	
Return (5 journeys × 8 tonne + 6 journeys × 6 tonne + 1 journey × 6 tonne)	82	

Total weight	162	
No. of journeys	26	
Average weight (in tonne) (162÷26)	6.23	
Total Commercial Tonne-km (A×B)		44,856

2. Calculation of Absolute Tonne-km:

Particulars	Tonne-km.	Tonne-km.
Outward journeys:		
From city A to city B (10 journey × 300 km. × 6 tonne)	18,000	
From city A to city C (2 journeys × 140 km. × 6 tonne)	1,680	
From city C to city B (2 journeys × 160 km. × 4 tonne)	1,280	20,960
Return journeys:		
From city B to city A (5 journeys × 300 km. × 8 tonne) + (6 journeys × 300 km. × 6 tonne)	22,800	
From city B to city C (1 journey × 160 km. × 6 tonne)	960	23,760
Total Absolute Tonne-km		44,720

Note: (i) While calculating absolute/commercial tonne-km., actual load carried are considered irrespective of the fact it attracts fines or penalty. (ii) Penalty paid for overloading is an abnormal expenditure and is not included in the operating cost of the lorry. This amount will be debited to Costing Profit and Loss A/c and hence deducted from operating profit to arrive at net profit/loss.



6. COSTING OF HOTELS AND LODGES

Service costing is an effective tool in respect of hotel industry. Hotels are run on commercial basis. Hence it is necessary to compute the cost - to fix the price of various services provided by the hotel and to find out the profit or loss at the end of a particular period.

In this case, the costs associated with different services offered should be identified and cost per unit should be worked out. The cost unit may be Guest-day or Room Day. For calculation of cost per Guest Day or Room Day, estimated occupancy rate – at different point of time, for example – Peak season or lien season, are taken in to account.

ILLUSTRATION 6

A company runs a holiday home. For this purpose, it has hired a building at a rent of ₹ 10,000 per month along with 5% of total taking. It has three types of suites for its customers, viz., single room, double rooms and triple rooms.

Following information is given:

Type of suite	Number	Occupancy percentage
Single room	100	100%
Double rooms	50	80%
Triple rooms	30	60%

The rent of double rooms suite is to be fixed at 2.5 times of the single room suite and that of triple rooms suite as twice of the double room's suite.

The other expenses for the year 2022-23 are as follows:

	(₹)
Staff salaries	14,25,000
Room attendants' wages	4,50,000
Lighting, heating and power	2,15,000
Repairs and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	1,53,000

Provide profit @ 20% on total taking and assume 360 days in a year.

You are required to CALCULATE the rent to be charged for each type of suite.

SOLUTION**Working Notes:****(i) Total equivalent single room suites**

Nature of suite	Occupancy (Room-days)	Equivalent single room suites (Room-days)
Single room suites	36,000 (100 rooms × 360 days × 100%)	36,000 (36,000 × 1)
Double rooms suites	14,400 (50 rooms × 360 days × 80%)	36,000 (14,400 × 2.5)
Triple rooms suites	6,480 (30 rooms × 360 days × 60%)	32,400 (6,480 × 5)
		1,04,400

(ii) Statement of total cost:

	(₹)
Staff salaries	14,25,000
Room attendant's wages	4,50,000
Lighting, heating and power	2,15,000
Repairs and renovation	1,23,500
Laundry charges	80,500
Interior decoration	74,000
Sundries	1,53,000
	25,21,000
Building rent {(₹10,000 × 12 months) + 5% on total taking}	1,20,000 + 5% on total takings
Total cost	26,41,000 + 5% on total takings

Profit is 20% of total takings

\therefore Total takings = ₹ 26,41,000 + 25% (5% + 20%) of total takings

Let R be rent for single room suite

Then $1,04,400 R = 26,41,000 + (0.25 \times 1,04,400 R)$

Or, $1,04,400 R = 26,41,000 + 26,100 R$

Or, $78,300 R = 26,41,000$

Or, $R = ₹33.73$

Alternatively

Let total takings be x

$\therefore X = 26,41,000 + .25X (5\% + 20\%)$

$\therefore X = 35,21,333$

Let the rent of single room be R

Then $1,04,400 R = 35,21,333$

Or, $R = ₹33.73$

Rent to be charged:

Rent to be charged for single room suite = ₹33.73

Rent for double rooms suites ₹ 33.73 \times 2.5 = ₹84.33

Rent for triple rooms suites ₹33.73 \times 5 = ₹168.65

ILLUSTRATION 7

A lodging home is being run in a small hill station with 100 single rooms. The home offers concessional rates during six off- season months in a year when numbers of visitor are limited. During this period, half of the full room rent is charged. The management's profit margin is targeted at 20% of the room rent. The following are the cost estimates and other details for the year ending on 31st March. [Assume a month to be of 30 days].

- (i) *Occupancy during the season is 80% while in the off- season it is 40% only.*
- (ii) *Total investment in the home is ₹ 200 lakhs of which 80% relate to buildings and balance for furniture and equipment.*

(iii) Expenses:

o Staff salary [Excluding room attendants] :	₹ 5,50,000
o Repairs to building :	₹ 2,61,000
o Laundry charges :	₹ 80, 000
o Interior :	₹ 1,75,000
o Miscellaneous expenses :	₹ 1,90,800

(iv) Annual depreciation is to be provided for buildings @ 5% and on furniture and equipment @ 15% on straight-line basis.

(v) Room attendants are paid ₹ 10 per room day on the basis of occupancy of the rooms in a month.

(vi) Monthly lighting charges are ₹ 120 per room, except in four months in winter when it is ₹ 30 per room.

You are required to WORK OUT the room rent chargeable per day both during the season and the off-season months on the basis of the foregoing information.

SOLUTION

Working Notes:

(i) Total Room days in a year

Season	Occupancy (Room-days)	Equivalent Full Room charge days
Season – 80% Occupancy	100 Rooms × 80% × 6 months × 30 days in a month = 14,400 Room Days	14,400 Room Days × 100% = 14,400
Off-season – 40% Occupancy	100 Rooms × 40% × 6 months × 30 days in a month = 7,200 Room Days	7,200 Room Days × 50% = 3,600
Total Room Days	14,400 + 7,200 = 21,600 Room Days	18,000 Full Room days

(ii) Lighting Charges:

It is given in the question that lighting charges for 8 months is ₹120 per month and during winter season of 4 months it is ₹30 per month. Further it is also given that peak season is 6 months and off season is 6 months.

It should be noted that – being Hill station, winter season is to be considered as part of Off season. Hence, the non-winter season of 8 months include – Peak season of 6 months and Off season of 2 months.

Accordingly, the lighting charges are calculated as follows:

Season	Occupancy (Room-days)
Season & Non-winter – 80% Occupancy	100 Rooms × 80% × 6 months × ₹120 per month = ₹ 57,600
Off- season & non-winter – 40% Occupancy (8 – 6 months)	100 Rooms × 40% × 2 months × ₹120 per month = ₹ 9,600
Off- season & -winter – 40% Occupancy months)	100 Rooms × 40% × 4 months × ₹ 30 per month = ₹ 4,800
Total Lighting charges	₹ 57,600+ 9,600 + 4,800 = ₹ 72,000

Statement of total cost:

	(₹)
Staff salary	5,50,000
Repairs to building	2,61,000
Laundry & Linen	80,000
Interior	1,75,000
Sundries Expenses	1,90,800
Depreciation on Building (₹ 200 Lakhs × 80% × 5%)	8,00,000
Depreciation on Furniture & Equipment (₹ 200 Lakhs × 20% × 15%)	6,00,000
Room attendant's wages (₹ 10 per Room Day for 21,600 Room Days)	2,16,000
Lighting charges	72,000

Total cost	29,44,800
Add: Profit Margin (20% on Room rent or 25% on Cost)	7,36,200
Total Rent to be charged	36,81,000

Calculation of Room Rent per day:

Total Cost / Equivalent Full Room days = ₹ 36,81,000 / 18,000 = ₹204.50

Room Rent during Season – ₹204.50

Room Rent during Off season = ₹204.50 × 50% = ₹ 102.25

7. COSTING OF HOSPITALS

A Hospital is providing various types of medical services to the patients. Hospital costing is applied to decide the cost of these services.

A hospital may have different departments catering to varied services to the patients – such as

- Out Patient
- In Patient
- Medical services like X-Ray, Scanning, etc.
- General services like Catering, Laundry, Power house, etc.
- Miscellaneous services like Transport, Dispensary, etc.

7.1 Unit of Cost

Common unit of costs of various departments are as follows:

- Out Patient – Per Out-patient
- In Patient – Per Room Day
- Scanning – Per Case
- Laundry – Per 100 items laundered

7.2 Cost Segregation

The cost of hospital can be divided in to fixed costs and variable costs

Fixed costs are based on timelines and irrespective of services provided. For example, Staff salaries, Depreciation on Building and Equipment, etc.

Variable costs vary with the level of services rendered. For example, laundry charges, Cost of food supplied to patients, Power, etc.

ILLUSTRATION 8

ABC Hospital runs a Critical Care Unit (CCU) in a hired building. CCU consists of 35 beds and 5 more beds can be added, if required.

Rent per month - ₹ 75,000

Supervisors – 2 persons – ₹ 25,000 Per month – each

Nurses – 4 persons – ₹ 20,000 per month – each

Ward Boys – 4 persons – ₹ 5,000 per month – each

Doctors paid ₹ 2,50,000 per month – paid on the basis of number of patients attended and the time spent by them

Other expenses for the year are as follows:

Repairs (Fixed) – ₹ 81,000

Food to Patients (Variable) – ₹ 8,80,000

Other services to patients (Variable) – ₹ 3,00,000

Laundry charges (Variable) – ₹ 6,00,000

Medicines (Variable) – ₹ 7,50,000

Other fixed expenses – ₹ 10,80,000

Administration expenses allocated – ₹ 10,00,000

It was estimated that for 150 days in a year 35 beds are occupied and for 80 days only 25 beds are occupied.

The hospital hired 750 beds at a charge of ₹ 100 per bed per day, to accommodate the flow of patients. However, this does not exceed more than 5 extra beds over and above the normal capacity of 35 beds on any day.

You are required to –

- (a) CALCULATE profit per Patient day, if the hospital recovers on an average ₹2,000 per day from each patient
- (b) FIND OUT Breakeven point for the hospital.

SOLUTION**Working Notes:****(1) Calculation of number of patient days**

35 Beds × 150 days	=	5,250
25 Beds × 80 days	=	2,000
Extra beds	=	<u>750</u>
Total	=	<u>8,000</u>

Statement of Profitability

Particulars	Amount	Amount
Income for the year (₹ 2,000 per patient per day × 8,000 patient days)		1,60,00,000
Variable Costs:		
Doctor Fees (₹ 2,50,000 per month × 12)	30,00,000	
Food to Patients (Variable)	8,80,000	
Other services to patients (Variable)	3,00,000	
Laundry charges (Variable) – (₹)	6,00,000	
Medicines (Variable) – (₹)	7,50,000	
Bed Hire Charges (₹100 × 750 Beds)	75,000	
Total Variable costs		56,05,000
Contribution		1,03,95,000
Fixed Costs:		
Rent (₹ 75,000 per month × 12)	9,00,000	
Supervisor (2 persons × ₹25,000 × 12)	6,00,000	
Nurses (4 persons × ₹ 20,000 × 12)	9,60,000	

Ward Boys (4 persons × ₹ 5,000 × 12)	2,40,000	
Repairs (Fixed)	81,000	
Other fixed expenses – (₹)	10,80,000	
Administration expenses allocated – (₹)	10,00,000	
Total Fixed Costs		48,61,000
Profit		55,34,000

(1) Calculation of Contribution per Patient day

Total Contribution – ₹ 1,03,95,000

Total Patient days – 8,000

Contribution per Patient day – ₹ 1,03,95,000 / 8,000 = ₹ 1,299.375

(2) Breakeven Point = Fixed Cost / Contribution per Patient day

= ₹ 48,61,000 / ₹1,299.375

= 3,741 patient days

8. COSTING OF IT & ITES

Information Technology (IT) and Information Technology Enabled Services (ITES) organizations provide their customers with services or intangible products. These organizations are highly labour intensive.

The services of IT and ITES organizations may be used for – provision of services to outside customers or provision of services internally (captive consumption)

In this sector employee (labour) cost constitutes a significant portion of the total operating costs. The direct employee cost is traceable to services rendered.

In addition to employee cost, significant overhead costs for offering the services are incurred and are classified as service overhead. To arrive at the cost incurred for rendering the services, it is necessary to allocate / apportion such overheads to cost units.

8.1 Concept of Project

In general – IT & ITES industries, the jobs undertaken are considered as Project. Each project is unique in nature and varies in size, functionality requirements, duration and staffing requirements.

When a project is taken up, a detailed planning is done – by breaking down the project into number of activities and their dependencies. Based on the above, project scheduling are developed.

Then the skill level requirement for carrying out each of the activities is identified and the duration of each and every activity would be ascertained. This process is known as effort estimation.

Once the skill level and duration is identified, then required man-power is identified for carrying out the activities.

Normally, project scheduling and effort estimation is carried out together. The costs of development are primarily the costs of the effort involved, so the effort computation is used in both the cost and the schedule estimate

8.2 Effort Involved

Direct Manpower

In a typical software implementation project, three to four levels of man-power would be directly engaged, as mentioned below: -

- Software Engineers / Functional Consultants / Business Analysts
- Project Leaders
- Project Manager
- Program Manager, etc

Depending on the nature and complexities of the projects being implemented, the number of persons engaged, their levels and duration of the engagement varies. For example, in a multi-continental, multi-time zone software implementation projects, in addition to the above manpower, Customer Account Manager, Portfolio Manager, etc may be involved.

The costs incurred on the above listed manpower are traceable with a project and hence forming part of direct costs of the project.

Support Manpower

In addition to the above persons, who are directly engaged in project, there could be support persons or indirect manpower, who are indirectly involved in the project.

For example, Quality Assurance Team, Testing Team, Version Control team, Staffing Manager, etc who are indirectly support the projects by providing required level of support services over the life of the projects.

It is possible that the indirect manpower may be involved in more than one project, simultaneously. Their time spent, may or may not be traced on any particular project and will be used across multiple projects.

If their time can be identified with a project, they will be treated as direct manpower. Accordingly, the cost incurred on them will be treated as direct cost.

However, if their time is not traceable with a single project, then it may either be allocated or apportioned to various projects on some suitable basis. Accordingly, the cost incurred on them will be treated as overhead and the same will be apportioned to various projects on some suitable basis.

Effort Cost in these types of organizations are calculated on the basis of cost per Person Day or cost per Person week or cost per Person month. That means cost incurred for a person for rendering services per day or per week or per month.

Depending on the requirement of the customer, the periodicity will be defined. For example, implementation of new software may require eight to twelve person months. In such a case, the cost will be calculated on Per Person month basis. On the other hand, implementation of one or two new functionality in already implemented (existing) software may require one- or two-week's efforts. In such a case, the cost will be calculated on per Person week basis.

8.3 Parameters in Computation of Total Cost

- A. Hardware and software costs involved
- If they are identifiable with a project, then they are directly allocated to the project
 - If they are not directly identifiable with a project or not fully allocable to a project, then they are treated as service overhead
- B. Travel and training costs
- If they are incurred for a project, then they are directly allocated to the project
 - If they are not directly identifiable with a project or allocable over a number of projects, then they are treated as service overhead. For example, Java (software language) training provided to the software engineers, may useful in multiple Java based projects. Hence treated as overhead costs
- C. Effort costs
- Effort costs are basically identified with a project. They can be classified as direct cost, unless otherwise specified.
 - Effort costs are not just the salaries of the software engineers or programmers who are involved in the project. Organisations compute effort costs in terms of overhead costs where they take the total cost of running the organisation and divide this by the number of productive staff. Therefore, the following costs are all part of the total effort cost:
 1. Costs of providing, heating and lighting office space
 2. Costs of support staff such as accountants, administrators, system managers, cleaners and technicians
 3. Costs of networking and communications
 4. Costs of central facilities such as a library or recreational facilities
 5. Costs of Social Security and employee benefits such as pensions and health insurance, etc.

In short, effort cost includes Salary of the staff concerned and part of common overhead.

ILLUSTRATION 9

Following are the data pertaining to Infotech Pvt. Ltd, for the year 2022-23:

	Amount (₹)
Salary to Software Engineers (5 persons)	15,00,000
Salary to Project Leaders (2 persons)	9,00,000
Salary to Project Manager	6,00,000
Repairs & maintenance	3,00,000
Administration overheads	12,00,000

The company executes a Project XYZ, the details of the same as are as follows:

Project duration – 6 months

One Project Leader and three Software Engineers were involved for the entire duration of the project, whereas Project Manager spends 2 months' efforts, during the execution of the project.

Travel expenses incurred for the project – ₹ 1,87,500

Two Laptops were purchased at a cost of ₹ 50,000 each, for use in the project and the life of the same is estimated to be 2 years

PREPARE Project cost sheet.

SOLUTION

Working Notes:

(1) Calculation of Cost per month and Overhead absorption rate

Particulars	Total Per Annum	Per Person Per Annum	Per Person Per Month
Salary to Software Engineer (5 Persons)	₹15,00,000	₹ 3,00,000	₹25,000
Salary to Project Leaders (2 persons)	₹ 9,00,000	₹ 4,50,000	₹ 37,500

Salary to Project Manager	₹ 6,00,000	₹ 6,00,000	₹ 50,000
Total	₹ 30,00,000		₹ 1,12,500

(2) **Total Overhead** = Repairs & maintenance + Administration overheads
 = ₹ 3,00,000 + ₹12,00,000 = ₹15,00,000

(3) **Calculation of Overhead absorption rate**

= Total Overhead / Total Salary = ₹15,00,000 / ₹30,00,000 = 50%

Project Cost Sheet

		(₹)
Salary Cost:		
Salary of Software Engineers	(3 × ₹ 25,000 × 6 months)	4,50,000
Salary of Project Leader	(₹ 37,500 × 6 months)	2,25,000
Salary of Project Manager	(₹ 50,000 × 2 months)	1,00,000
Total Salary		7,75,000
Overheads	(50% of Salary)	3,87,500
Travel Expenses		1,87,500
Depreciation on Laptops	(₹1,00,000 / 2 years × 6 months)	25,000
Total Project Cost		13,75,000

9. COSTING OF TOLL ROADS

The Construction of roads brings about a variety of benefits that are enjoyed practically by all sectors of the economy. Highway economic analysis is a technique whereby the cost and benefit from a scheme are quantified over a selected time horizon and evaluated by a common yardstick.

The economic analysis involves comparison of project costs and benefits under the "with" and "without" project conditions.

The project is further subjected to sensitivity analysis by assessing the effects of adverse changes in the key variables. In addition, the combined effect of these

changes is also assessed. This helps to gauge the economic strength of the project to withstand future risks and uncertainties.

9.1 Cost Involved

The project cost consists of following two main components:

9.1.1 Capital Costs

The capital cost consists of cost incurred during the construction period. Generally, this sort of road construction projects run across multiple financial years. The total expenditure to be incurred during the construction period is termed as capital cost.

The total cost includes the cost of construction of road and other structures and consultancy charges. In addition to this cost, it also includes the cost of construction of tollbooths.

Construction expenses can be broadly classified as follows:

- Preliminary and pre-operative expenses
- Land Acquisition
- Materials
- Labour
- Overheads incurred in the course of actual construction
- Contingency allowance
- Interest during construction period

9.1.2 Operating and Maintenance Costs

Routine maintenance cost would be incurred once the Toll road is operational. Routine maintenance involves Patching of potholes, sealing of cracks, Edge Repair, Surface Renewal, Periodic maintenance for new highways would be met with in accordance with the analysis of the life cycle model carried out for the project.

Annual operating cost includes the cost of operating tollbooths, administrative expenses, emergency services, communications and security services and other costs of operation.

Maintenance cost includes the cost of annual maintenance (routine) and periodic maintenance.

- Annual maintenance cost includes primary maintenance of wearing surface, railings, roadside furniture, etc.
- Periodic maintenance cost includes the cost of overlays (wearing coats), painting of railings, etc.

Operating and Maintenance expenses can be broadly classified as follows:

- Toll collection expenses
- Administrative expenses for day-to-day operation.
- Maintenance expenses, which include routing and periodic maintenance.
- Interest expenses incurred for servicing term loans.

9.2 Build-Operate-Transfer (BOT) Approach

In recent years a growing trend emerged among Governments in many countries to solicit investments for public projects from the private sector under BOT scheme. BOT is an option for the Government to outsource public projects to the private sector.

With BOT, the private sector designs, finances, constructs and operate the facility and eventually, after specified concession period, the ownership is transferred to the Government. Therefore, BOT can be seen as a developing technique for infrastructure projects by making them amenable to private sector participation.

The fundamental principle in determining user levy is, 'if the price for a transport facility is set at a level that reflects the benefit, each user gains from improvements in the facility, it will result in traffic flow levels that equate social costs with user benefits.'

9.3 Toll Rate

In general, the toll rate should have a direct relation with the benefits that the road users would gain from its improvements. The benefits to road users are likely to be in terms of fuel savings, improvement in travel time and good riding quality.

To compute the toll rate following formula with rounding off to nearest multiple of five has been adopted:

User Fee = Total Distance × Toll Rate per km

ILLUSTRATION 10

BHG Toll Plaza Ltd built a 60 km. long highway and now operates a toll plaza to collect tolls from passing vehicles using the highway. The company has estimated that a total of 12 crore vehicles (only single type of vehicle) will be using the highway during the 10 years toll collection tenure.

Toll Operating and Maintenance cost for the month of April are as follows:

(i) *Salary to –*

- *Collection Personnel (3 Shifts and 4 persons per shift) - ₹ 550 per day per person*
- *Supervisor (2 Shifts and 1 person per shift) - ₹ 750 per day per person*
- *Security Personnel (3 Shifts and 6 persons per shift) - ₹ 450 per day per person*
- *Toll Booth Manager (2 Shifts and 1 person per shift) - ₹ 900 per day per person*

(ii) *Electricity – ₹ 8,00,000*

(iii) *Telephone – ₹ 1,40,000*

(iv) *Maintenance cost – ₹ 30 Lakh*

Monthly depreciation and amortisation expenses will be ₹ 1.50 crore. Further, the company needs 25% profit over total cost to cover interest and other costs.

Required:

- (i) *CALCULATE cost per kilometer per month.*
- (ii) *CALCULATE the toll rate per vehicle.*

SOLUTION**Calculation of cost for the month of April**

Particulars		(₹)
Salary to Collection Personnel	(3 Shifts × 4 persons per shift × 30 days × ₹ 550 per day)	1,98,000
Salary to Supervisor	(2 Shifts × 1 persons per shift × 30 days × ₹ 750 per day)	45,000
Salary to Security Personnel	(3 Shifts × 6 persons per shift × 30 days × ₹ 450 per day)	2,43,000
Salary to Toll Booth Manager	(2 Shifts × 1 persons per shift × 30 days × ₹ 900 per day)	54,000
Electricity		8,00,000
Telephone		1,40,000
Maintenance cost		30,00,000
Total operating cost (A)		44,80,000
Depreciation and amortisation expenses (B)		1,50,00,000
Total Cost (A + B)		1,94,80,000

(i) Calculation of cost per kilometer per month:

$$= \frac{\text{Total Cost}}{\text{Total km.}} = \frac{₹ 1,94,80,000}{60 \text{ km.}} = ₹ 3,24,666.67$$

(ii) Calculation of toll rate per vehicle:

$$= \frac{\text{Total Cost} + 25\% \text{ profit}}{\text{Vehicles per month}} = \frac{₹ 1,94,80,000 + ₹ 48,70,000}{10,00,000 \text{ vehicles}} = ₹ 24.35$$

Working:

No. of vehicles using the highway per month

$$\frac{\text{Total estimated vehicles}}{10 \text{ years}} \times \frac{1 \text{ month}}{12 \text{ months}} = \frac{12 \text{ crore}}{10 \text{ years}} \times \frac{1 \text{ month}}{12 \text{ months}} = 10 \text{ lakhs}$$

10. COSTING OF EDUCATIONAL INSTITUTIONS

Educational institutions like schools, colleges, technical institutes for education and training, are run to impart education and training to students. The objective of running these institutions may be 'Not-for profit' or 'For profit'. Like other business entities, cost and management accounting is also inevitable for this sector. The Government, Local body of any other organisation which provides education and training to students with an objective to benefit and upliftment of the society, are also need cost and management accounting system for cost-social benefit analysis, allocation of funds and budgeting (zero-based budgeting), performance measurement and evaluation etc.

10.1 Income of the Educational Institutions

The source of income of an institute may be classified on the basis of recurrence as follows:

One-time fees: These are the fees which are collected once in a course period or for a definite period like Admission fee, Development fee, Annual fee etc.

Recurring fees: Tuition fee, laboratory, computer and internet fee, library fee, training fee, amenities fee, sports fee, extracurricular activities fee etc.

The Government and other aided institutes may not be permitted to collect various fees like capitation fee and development fees etc. Further, unlike the trading and manufacturing organizations, these are not free to determine fees beyond a prescribed limit.

Other incomes: The indirect income like transport, hostel, mess and canteen for the students and staff are provided by the educational institutions normally on no profit no loss basis.

10.2 Expenditure of the Educational Institutions

(i) Operational Cost:

Following are the major operational costs incurred by an educational institution:

- The salary of the teaching and non-teaching staff
- Laboratory maintenance charges

- Computer maintenance and internet charges,
- Building maintenance,
- Repairs and maintenance of equipment,
- Administrative expenses,
- Finance charges etc.

Cost Centres and basis of cost allocation

Cost centres in educational institutions are classified as follows:

- Primary or Direct cost centres (like Civil Engineering department, Mechanical Engineering department, etc.)
- Service cost centres (like Laboratory, Library, Sports, etc.)
- Student's Self-Supporting Services (like Transport, Hostel & Mess, etc.)
- Administration Cost centres (like Research & Improvement, Examination)

Costs incurred are allocated to the respective cost centres, if they are identifiable with a cost centre and apportioned to service and administration cost centres on suitable basis.

(ii) Research and Development Cost

Educational institutions undertake academic research on various fields of specializations. The costs of such research including personal costs, books etc. are to be collected through a cost centre approach. All costs incurred in that cost centre are collected and set off against the revenue generated from such research projects.

If any balance is left out as undistributed, then such balance costs can be collectively distributed to all other course cost centre as a separate cost element namely "Research costs".

(iii) Cost of Publication of research and other materials

In an educational institution, there will be a separate department for conducting research publication related exercise. The cost incurred would be directly allocated to that department.

ILLUSTRATION 11

AD Higher Secondary School (AHSS) offers courses for 11th & 12th standard in three streams i.e. Arts, Commerce and Science. AHSS runs higher secondary classes along with primary and secondary classes, but for accounting purpose it treats higher secondary as a separate responsibility centre. The Managing committee of the school wants to revise its fee structure for higher secondary students. The accountant of the school has provided the following details for a year:

	Amount (₹)
Teachers' salary (25 teachers × ₹ 35,000 × 12 months)	1,05,00,000
Principal's salary	14,40,000
Lab attendants' salary (2 attendants × ₹ 15,000 × 12 months)	3,60,000
Salary to library staff	1,44,000
Salary to peons (4 peons × ₹ 10,000 × 12 months)	4,80,000
Salary to other staffs	4,80,000
Examinations expenditure	10,80,000
Office & Administration cost	15,20,000
Annual day expenses	4,50,000
Sports expenses	1,20,000

Other information:

(i)

	Standard 11 & 12			Primary & Secondary
	Arts	Commerce	Science	
No. of students	120	360	180	840
Lab classes in a year	0	0	144	156
No. of examinations in a year	2	2	2	2
Time spent at library by students per year	180 hours	120 hours	240 hours	60 hours

Time spent by principal for administration	208 hours	312 hours	480 hours	1,400 hours
Teachers for 11 & 12 standard	4	5	6	10

- (ii) One teacher who teaches economics for Arts stream students also teaches commerce stream students. The teacher takes 1,040 classes in a year, it includes 208 classes for commerce students.
- (iii) There is another teacher who teaches mathematics for Science stream students also teaches business mathematics to commerce stream students. She takes 1,100 classes a year, it includes 160 classes for commerce students.
- (iv) One peon is fully dedicated for higher secondary section. Other peons dedicate their 15% time for higher secondary section.
- (v) All school students irrespective of section and age participates in annual functions and sports activities.

Required:

- (a) CALCULATE cost per student per annum for all three streams.
- (b) If the management decides to take uniform fee of ₹ 1,000 per month from all higher secondary students, CALCULATE stream wise profitability.
- (c) If management decides to take 10% profit on cost, COMPUTE fee to be charged from the students of all three streams respectively.

SOLUTION

Calculation of Cost per annum

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Teachers' salary (W.N-1)	16,80,000	21,00,000	25,20,000	63,00,000
Re-apportionment of Economics & Mathematics teachers' salary (W.N- 2)	(84,000)	1,45,091	(61,091)	-

Principal's salary (W.N-3)	1,24,800	1,87,200	2,88,000	6,00,000
Lab assistants' salary (W.N-4)	-	-	1,72,800	1,72,800
Salary to library staff (W.N-5)	43,200	28,800	57,600	1,29,600
Salary to peons (W.N-6)	31,636	94,909	47,455	1,74,000
Salary to other staffs (W.N-7)	38,400	1,15,200	57,600	2,11,200
Examination expenses (W.N- 8)	86,400	2,59,200	1,29,600	4,75,200
Office & Administration expenses (W.N- 7)	1,21,600	3,64,800	1,82,400	6,68,800
Annual Day expenses (W.N-7)	36,000	1,08,000	54,000	1,98,000
Sports expenses (W.N- 7)	9,600	28,800	14,400	52,800
Total Cost per annum	20,87,636	34,32,000	34,62,764	89,82,400

(i) Calculation of cost per student per annum

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Total Cost per annum	20,87,636	34,32,000	34,62,764	89,82,400
No. of students	120	360	180	660
Cost per student per annum	17,397	9,533	19,238	13,610

(ii) Calculation of profitability

Particulars	Arts (₹)	Commerce (₹)	Science (₹)	Total (₹)
Total Fees per annum	12,000	12,000	12,000	
Cost per student per annum	17,397	9,533	19,238	
Profit/ (Loss) per student per annum	(5,397)	2,467	(7,238)	
No. of students	120	360	180	
Total Profit/ (Loss)	(6,47,640)	8,88,120	(13,02,840)	(10,62,360)

(iii) Computation of fees to be charged to earn a 10% profit on cost

Particulars	Arts (₹)	Commerce (₹)	Science (₹)
Cost per student per annum	17,397	9,533	19,238
Add: Profit @10%	1,740	953	1,924
Fees per annum	19,137	10,486	21,162
Fees per month	1,595	874	1,764

Working Notes:

(1) Teachers' salary

Particulars	Arts	Commerce	Science
No. of teachers	4	5	6
Salary per annum (₹) (₹ 35,000 x 12)	4,20,000	4,20,000	4,20,000
Total salary	16,80,000	21,00,000	25,20,000

(2) Re-apportionment of Economics and Mathematics teachers' salary

Particulars	Economics		Mathematics	
	Arts	Commerce	Science	Commerce
No. of classes	832	208	940	160
Salary re-apportionment (₹)	(84,000)	84,000	(61,091)	61,091
	$\left(\frac{₹4,20,000}{1,040} \times 208 \right)$		$\left(\frac{₹4,20,000}{1,100} \times 160 \right)$	

- (3) Principal's salary has been apportioned on the basis of time spent by him for administration of classes.
- (4) Lab attendants' salary has been apportioned on the basis of lab classes attended by the students.
- (5) Salary of library staffs are apportioned on the basis of time spent by the students in library.

- (6) Salary of Peons are apportioned on the basis of number of students. The peons' salary allocable to higher secondary classes is calculated as below:

	Amount (₹)
Peon dedicated for higher secondary (1 peon × ₹10,000 × 12 months)	1,20,000
<i>Add:</i> 15% of other peons' salary {15% of (3 peons × ₹10,000 × 12 months)}	54,000
	1,74,000

- (7) Salary to other staffs, office & administration cost, Annual day expenses and sports expenses are apportioned on the basis of number of students.
- (8) Examination expenses has been apportioned taking number of students into account (It may also be apportioned on the basis of number of examinations).



11. COSTING IN INSURANCE COMPANIES

Insurance or assurance industry operates in providing social security to the persons who subscribe for the policy. The Insurance companies are broadly classified as Life insurer and Non-Life Insurer (General Insurance providers). Life insurers provide assurance to the policy holders' life for the insured value. The Non-life insurers are providing insurance to the policyholder for actual loss upto insured value for the policy.

The insurance companies are need to analyse it various insurance product for profitability. The product offered by insurance companies may include:

- (i) Life Insurance policies- with or without maturity benefits
- (ii) General insurance- Health, Fire, Property, Travel Insurance etc.
- (iii) Others services- Re-insurance, Fund management- Pension, Gratuity and other etc.

11.1 Income of Insurance Companies

Income of insurance companies may include

- (i) Premium on policy (periodic or onetime)
- (ii) Commission on re-insurance
- (iii) Fund administration fee and return on investment of funds etc.

11.2 Expenditure of Insurance Companies

The Expenditure of an insurance company can be classified as direct and indirect to a policy or product.

Direct- Commission paid to agents, claim settlement, cost of valuation, premium for re-insurance, legal and other costs etc.

Indirect Cost- Actuarial fees, market and product development costs, administration cost, asset management cost etc.

11.3 Method of Costing in an Insurance Company

The cost object in an insurance company may be a product, a policy, a department or region, an agent etc.

Activity Based Costing in Insurance Companies

Activity based costing (ABC) is used for analysis of cost-benefit of a product (Direct Product Profitability), policy profitability (Customer Profitability Analysis) etc.

Costs that occur in insurance companies are to be identified with appropriate activities that have caused its occurrence. Then costs must be reassigned from activities to cost objects (insurance contracts and policies, customers, delivery channels) based on identified cost drivers.

Identification of activities and assignment of costs are the most critical for the implementation of activity-based costing. The activities can be divided into two parts i.e. (i) Pre-product development activities and (ii) Post product development activities.

(i) Pre-product development activities: These are the activities which are carried out before a product is made. It includes market research, product

development like specification of coverage, conditions, amount of premium, insurance contract, policy forms and provision for sales channel etc.

(ii) Post product development activities: This activity is further divided into parts i.e. (a) Selling of policy and (b) Processing of claims. (a) Selling of policy refers to appointment of distribution of sales channel (direct selling or through agencies), soliciting for policy, processing of applications etc. (b) Processing of claim includes claim inception, claim estimation, claim settlement and legal actions.

The activities costs are assigned to the products on the basis of appropriate cost drivers. The cost drivers may include no. of hours spent on processing of an application and claim processing, no. of application, no. of policy, no. of claim etc.

ILLUSTRATION 12

Sanziet Lifecare Ltd. operates in life insurance business. Last year it launched a new term insurance policy for practicing professionals 'Professionals Protection Plus'. The company has incurred the following expenditures during the last year for the policy:

	₹
Policy development cost	11,25,000
Cost of marketing of the policy	45,20,000
Sales support expenses	11,45,000
Policy issuance cost	10,05,900
Policy servicing cost	35,20,700
Claims management cost	1,25,600
IT cost	74,32,000
Postage and logistics	10,25,000
Facilities cost	15,24,000
Employees cost	5,60,000
Office administration cost	16,20,400

Number of policies sold- 528

Total insured value of policies- ₹ 1,320 crore

Required:

- (i) CALCULATE total cost for Professionals Protection Plus policy segregating the costs into four main activities namely (a) Marketing and Sales support, (b) Operations, (c) IT and (d) Support functions.
- (ii) CALCULATE cost per policy.
- (iii) CALCULATE cost per rupee of insured value.

SOLUTION**(i) Calculation of total cost for 'Professionals Protection Plus policy**

Particulars		Amount (₹)	Amount (₹)
1.	Marketing and Sales support:		
	- Policy development cost	11,25,000	
	- Cost of marketing	45,20,000	
	- Sales support expenses	11,45,000	67,90,000
2.	Operations:		
	- Policy issuance cost	10,05,900	
	- Policy servicing cost	35,20,700	
	- Claims management cost	1,25,600	46,52,200
3.	IT Cost		74,32,000
4.	Support functions		
	- Postage and logistics	10,25,000	
	- Facilities cost	15,24,000	
	- Employees cost	5,60,000	
	- Office administration cost	16,20,400	47,29,400
	Total Cost		2,36,03,600

$$(ii) \text{ Calculation of cost per policy} = \frac{\text{Total cost}}{\text{No. of policies}} = \frac{₹2,36,03,600}{528} = ₹ 44,703.79$$

$$(iii) \text{ Cost per rupee of insured value} = \frac{\text{Total cost}}{\text{Total insured value}} = \frac{₹ 2.36 \text{ crore}}{₹ 1,320 \text{ crore}} \\ = ₹ 0.0018$$

12. COSTING IN FINANCIAL INSTITUTIONS

In the past two-decade financial institutions have undergone major changes – in terms to increased regulations, competition from new entrants from both locally and globally, innovation of new products and services, technological advancement and increased expectations of new generation customers, etc.

Over and above the challenges posed by the prevailing environment as described above, financial institutions underwent considerable changes in terms of its high quality, sensitive staffing requirements and its productivity.

Manpower cost, other than interest cost and finance charges, is one of the largest single cost components in financial institutions. Hence, it is needless to say, that financial institutions are more interested in understanding and discovering the ways to more accurately allocate such costs to various product ranges offered by them and its customers.

If the financial institution is to survive under the present challenging economic conditions, it will have to add value to its products and services. It is imperative to note that the financial institution needs to know the contribution of its products, services and customers to value creation.

12.1 Cost Measurement in Financial Institutions

The objectives of cost measurement include –

- Understand the profitability by products offered and by customers
- Establishing a mechanism for pricing the products, by identifying the product level and activity level unit costs
- Understanding productivity issues and their relationship with strategic goals of the organization

In nutshell, financial institutions need to understand their position in various product lines and to find out how they can stay in competing edge or becomes a leader.

12.2 Activity Based Costing in Financial Institutions

Activity based costing can be a useful tool in allocating the cost elements to various products offered and the customers being serviced.

Activity based costing can help financial institutions to –

- Identify and analyze the profitability by product
- Analyze the profitability by customer
- Identify the activity level unit costs and build up product level costs, which in turn forms basis for product level pricing / customer level pricing

Financial institutions can improve their profitability by –

- Concentrating on products that are more profitable
- Focus on high margin customers

Costs that occur in financial institutions are to be identified with appropriate activities that have caused its occurrence. Then costs must be reassigned from activities to cost objects (various loan products offered by the organization, customers, etc.) based on identified cost drivers.

The concepts on activity-based costing as discussed under Costing of Insurance Companies also applicable to financial institutions. Please refer the same.

ILLUSTRATION 13

The loan department of a bank performs several functions in addition to home loan application processing task. It is estimated that 25% of the overhead costs of loan department are applicable to the processing of home-loan application. The following information is given concerning the processing of a loan application:

Direct professional labor:

	(₹)
Loan processor monthly salary:	<u>2,40,000</u>
(4 employees @ ₹60,000 each)	
Loan department overhead costs (monthly)	
Chief loan officer's salary	75,000
Telephone expenses	7,500

<i>Depreciation Building</i>	28,000
<i>Legal advice</i>	24,000
<i>Advertising</i>	40,000
<i>Miscellaneous</i>	6,500
<i>Total overhead costs</i>	1,81,000

You are required to COMPUTE the cost of processing home loan application on the assumption that five hundred home loan applications are processed each month.

SOLUTION

Statement showing computation of the cost of processing a typical home loan application

	(₹)
Direct professional labour cost	2,40,000
(4 employees @ ₹ 60,000 each)	
Service overhead cost (25% of ₹ 1,81,000)	<u>45,250</u>
Total processing cost per month	2,85,250
No. of applications processed per month	500
Total processing cost per home loan application	570.5

13. OTHER SERVICES- COSTING FOR POWER HOUSES

Power houses are engaged either in electricity generation or steam generation use the concepts of service costing i.e., 'Powerhouse Costing.' Service cost statement can be prepared by identifying the costs associated with the power generation or steam generation.

Cost unit is different for electricity generation and steam generation.

The cost unit for electricity generation organization is cost per kilowatt-hour (kWh) – that means cost of generating one kilowatt of power per hour. Please note that kWh is commonly known as a "Unit".

The costs are shown under the following heads:

(i) **Standing Charges or Fixed costs:** These are the fixed costs that remain constant irrespective of the power or stream generated. These costs include the following:

- Rent, Rates & Taxes
- Insurance
- Depreciation
- Salaries, if paid on Time (Monthly) basis
- Administration expenses, etc.

(ii) **Variable costs or Running costs:** These costs are generally associated with the power or stream generated. These costs include the following:

- Fuel Charges
- Water Charges
- Wages / Labour charges, if paid on the basis of production
- Any other variable costs identified.

(iii) **Semi-variable costs or Maintenance costs:** These costs include the following:

- Meters
- Furnaces
- Service materials
- Tools, etc.

ILLUSTRATION 14

PREPARE the cost statement of Ignus Thermal Power Station showing the cost of electricity generated per kWh, from the data provided below pertaining to the year 2022-23.

Total units generated 20,00,000 kWh

	Amount (₹)
<i>Operating labour</i>	<i>30,00,000</i>

Repairs & maintenance	10,00,000
Lubricants, spares and stores	8,00,000
Plant supervision	6,00,000
Administration overheads	40,00,000

5 kWh. of electricity generated per kg of coal consumed @ ₹ 4.25 per kg. Depreciation charges @ 5% on capital cost of ₹ 5,00,00,000.

SOLUTION

Cost Statement of Ignus Thermal Power Station

Total units generated

20,00,000 kwh.

	Per annum (₹)	Per kWh (₹)
Fixed costs:		
Plant supervision	6,00,000	
Administration overheads	40,00,000	
Depreciation (5% of ₹ 5,00,00,000 p.a.)	25,00,000	
Total fixed cost: (A)	71,00,000	3.55
Variable costs:		
Operating labour	30,00,000	
Lubricants, spares and stores	8,00,000	
Repairs & maintenance	10,00,000	
Coal cost (Refer to working note)	17,00,000	
Total variable cost: (B)	65,00,000	3.25
Total cost [(A) + (B)]	1,36,00,000	6.80

Working Note:

Coal cost (20,00,000 kwh. ÷ 5 kwh) × ₹ 4.25 per kg. = ₹ 17,00,000

ILLUSTRATION 15

Solar Power Ltd. has a power generation capacity of 1000 Megawatt per day. On an average it operates at 85% of its installed capacity. The cost structure of the plant is as under:

	Cost particulars	Amount (₹ in Lakh)
1.	Employee cost per year	2500
2.	Solar panel maintenance cost per year	250
3.	Site maintenance cost per year	150
4.	Depreciation per year	5940

CALCULATE cost of generating 1kW of power.

[1 Megawatt = 1,000 kW]

SOLUTION

Working:

- Estimated power generated in a year
 = 1000 Megawatt × 85% × 365 days
 = 3,10,250 Megawatt

Calculation of 1 kW power generation cost:

	Cost particulars	Amount (₹ in Lakh)
A.	Employee cost per year	2500
B.	Solar panel maintenance cost per year	250
C.	Site maintenance cost per year	150
D.	Depreciation per year	5940
E.	Total Cost [A+B+C+D]	8840
F.	Estimated power generated (in Megawatt) (Refer working note-1)	3,10,250
G.	Cost of generating 1 Megawatt (₹) [(E÷F)×1,00,000]	2,849.31
H.	Cost of 1 kW (₹) [G÷1,000]	2.849

SUMMARY

- ◆ **Service Costing:** It is application of cost concepts in ascertainment of cost or providing services. It is also known as operating costing as relates to operating of a service.
- ◆ **Composite Cost Unit:** Unit of service cost consists of two different units.
- ◆ **Key Performance Indicators (KPIs):** KPIs are the quantitative and qualitative factors which are commonly used to assess the performance of an organization which are important to achieve its goal.
- ◆ **Equivalent Service unit:** To calculate cost or pricing of two more different grade of services which uses common resources, each grade of service is assigned a weight and converted into equivalent units. Converting services into equivalent units make different grade of services equivalent and comparable.
- ◆ **Build-Operate-Transfer (BOT):** With BOT, the private sector designs, finances, constructs and operate the facility and eventually, after specified concession period, the ownership is transferred to the Government. Therefore, BOT can be seen as a developing technique for infrastructure projects by making them amenable to private sector participation.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *Composite cost unit for a hospital is:*
 - (a) *Per patient*
 - (b) *Per patient-day*
 - (c) *Per day*
 - (d) *Per bed*
2. *Cost of diesel and lubricant is an example of:*
 - (a) *Operating cost*
 - (b) *Fixed charges*

- (c) *Semi-variable cost*
 - (d) *None of the above*
3. *Cost units used in power sector is:*
- (a) *Kilo meter (K.M)*
 - (b) *Kilowatt-hour (kWh)*
 - (c) *Number of electric points*
 - (d) *Number of hours*
4. *Absolute Tonne-km. is an example of:*
- (a) *Composite units in power sector*
 - (b) *Composite unit of transport sector*
 - (c) *Composite unit for bus operation*
 - (d) *Composite unit for oil and natural gas*
5. *Depreciation is treated as fixed cost if it is related to:*
- (a) *Activity level*
 - (b) *Related with machine hours*
 - (c) *Efflux of time*
 - (d) *None of the above*
6. *Jobs undertaken by IT & ITES organizations are considered as:*
- (a) *Project*
 - (b) *Batch work*
 - (c) *Contract*
 - (d) *All the above*
7. *In Toll Road costing, the repetitive costs include:*
- (a) *Maintenance cost*
 - (b) *Annual operating costs*

- (c) *None of the above*
 - (d) *Both (a) and (b)*
8. *BOT approach means:*
- (a) *Build, Operate and Transfer*
 - (b) *Buy, Operate and Transfer*
 - (c) *Build, Operate and Trash*
 - (d) *Build, Own and Trash*
9. *Pre-product development activities in insurance companies, include:*
- (a) *Processing of Claim*
 - (b) *Selling of policy*
 - (c) *Provision of conditions*
 - (d) *Policy application processing*
10. *Which of the following costing method is not appropriate for costing of educational institutes:*
- (a) *Batch Costing*
 - (b) *Activity Based Costing*
 - (c) *Absorption Costing*
 - (d) *Process Costing*

Theoretical Questions

1. *EXPLAIN briefly, what do you understand by Service Costing.*
2. *STATE how are composite units computed.*
3. *STATE the features of service costing.*

Practical Problems

1. *SLS Infrastructure built and operates 110 k.m. highway on the basis of Built-Operate-Transfer (BOT) for a period of 25 years. A traffic assessment carried out to estimate the traffic flow per day shows the following figures:*

Sl. No.	Type of vehicle	Daily traffic volume
1.	Two wheelers	44,500
2.	Car and SUVs	3,450
3.	Bus and LCV	1,800
4.	Heavy commercial vehicles	816

The following is the estimated cost of the project:

Sl. No.	Activities	Amount (₹ in lakh)
1	Site clearance	170.70
2	Land development and filling work	9,080.35
3	Sub base and base courses	10,260.70
4	Bituminous work	35,070.80
5	Bridge, flyovers, underpasses, Pedestrian subway, footbridge, etc	29,055.60
6	Drainage and protection work	9,040.50
7	Traffic sign, marking and road appurtenance	8,405.00
8	Maintenance, repairing and rehabilitation	12,429.60
9	Environmental management	982.00
	Total Project cost	114,495.25

An estimated cost of ₹1,120 lakh has to be incurred on administration and toll plaza operation.

On the basis of the vehicle specifications (i.e. weight, size, time saving etc.), the following weights has been assigned to the passing vehicles:

Sl. No.	Type of vehicle	
1.	Two wheelers	5%
2.	Car and SUVs	20%
3.	Bus and LCV	30%
4.	Heavy commercial vehicles	45%

Required:

- (i) *CACULATE* the total project cost per day of concession period.
- (ii) *COMPUTE* toll fee to be charged for per vehicle of each type, if the company wants to earn a profit of 15% on total cost.

[Note: Concession period is a period for which an infrastructure is allowed to operate and recovers its investment]

2. Mr. X owns a bus which runs according to the following schedule:

(i)	Delhi to Chandigarh and back, the same day.	
	Distance covered:	250 km. one way.
	Number of days run each month:	8
	Seating capacity occupied	90%.
(ii)	Delhi to Agra and back, the same day.	
	Distance covered:	210 km. one way
	Number of days run each month:	10
	Seating capacity occupied	85%
(iii)	Delhi to Jaipur and back, the same day.	
	Distance covered:	270 km. one way
	Number of days run each month:	6
	Seating capacity occupied	100%
(iv)	Following are the other details:	
	Cost of the bus	₹ 12,00,000
	Salary of the Driver	₹ 24,000 p.m.
	Salary of the Conductor	₹ 21,000 p.m.
	Salary of the part-time Accountant	₹ 5,000 p.m.
	Insurance of the bus	₹ 4,800 p.a.
	Diesel consumption 4 km. per litre at	₹ 56 per litre
	Road tax	₹ 15,915 p.a.

Lubricant oil	₹ 10 per 100 km.
Permit fee	₹ 315 p.m.
Repairs and maintenance	₹ 1,000 p.m.
Depreciation of the bus	@ 20% p.a.
Seating capacity of the bus	50 persons.

Passenger tax is 20% of the total takings.

CALCULATE the bus fare to be charged from each passenger to earn a profit of 30% on total takings. The fares are to be indicated per passenger for the journeys:

(i) Delhi to Chandigarh (ii) Delhi to Agra and (iii) Delhi to Jaipur.

3. A company is considering three alternative proposals for conveyance facilities for its sales personnel who has to do considerable traveling, approximately 20,000 kilometers every year. The proposals are as follows:

- (i) Purchase and maintain its own fleet of cars. The average cost of a car is ₹ 6,00,000.
- (ii) Allow the Executive use his own car and reimburse expenses at the rate of ₹ 10 per kilometre and also bear insurance costs.
- (iii) Hire cars from an agency at ₹ 1,80,000 per year per car. The company will have to bear costs of petrol, taxes and tyres.

The following further details are available:

Petrol ₹ 6 per km.	Repairs and maintenance ₹ 0.20 per km.
Tyre ₹ 0.12 per km.	Insurance ₹ 1,200 per car per annum
Taxes ₹ 800 per car per annum	Life of the car: 5 years with annual mileage of 20,000 km.

Resale value: ₹ 80,000 at the end of the fifth year.

WORK OUT the relative costs of three proposals and rank them.

4. From the following data pertaining to the year 2022-23 PREPARE a cost statement showing the cost of electricity generated per kwh by Chambal Thermal Power Station.

Total units generated	10,00,000 kWh
	(₹)
Operating labour	15,00,000
Repairs & maintenance	5,00,000
Lubricants, spares and stores	4,00,000
Plant supervision	3,00,000
Administration overheads	20,00,000

5 kWh. of electricity generated per kg. of coal consumed @ ₹ 4.25 per kg.
 Depreciation charges @ 5% on capital cost of ₹ 2,00,00,000.

Case Scenarios

1. A LMV Pvt. Ltd, operates cab/ car rental service in Delhi/NCR. It provides its service to the offices of Noida, Gurugram and Faridabad. At present it operates CNG fuelled cars but it is also considering to upgrade these into Electric vehicle (EV). The following details related with the owning of CNG & EV propelled cars are as tabulated below:

Particulars	CNG Car	EV Car
Car purchase price (₹)	9,20,000	15,20,000
Govt. subsidy on purchase of car (₹)	--	1,50,000
Life of the car	15 years	10 years
Residual value (₹)	95,000	1,70,000
Mileage	20 km/kg	240 km per charge
Electricity consumption per full charge	--	30 Kwh
CNG cost per Kg (₹)	60	--
Power cost per Kwh (₹)	--	7.60
Annual Maintenance cost (₹)	8,000	5,200
Annual insurance cost (₹)	7,600	14,600

Tyre replacement cost in every 5 - year (₹)	16,000	16,000
Battery replacement cost in every 8- year (₹)	12,000	5,40,000

Apart from the above, the following are the additional information:

Particulars	
Average distance covered by a car in a month	1,500 km
Driver's salary (₹)	20,000 p.m
Garage rent per car (₹)	4,500 p.m
Share of Office & Administration cost per car (₹)	1,500 p.m

You have been approached by the management of A LMV Pvt. Ltd. for consultation on the two options of operating the cab service. The expected questions that may be asked by the management are as follows:

- (i) What would be the depreciable value of EV Car?
- (a) ₹13,50,000
 (b) ₹15,20,000
 (c) ₹14,40,000
 (d) ₹12,00,000
- (ii) What would be the monthly cost of electricity for an EV car?
- (a) ₹1,425
 (b) ₹1,500
 (c) ₹1,450
 (d) ₹1,525
- (iii) What would be the total cost to be incurred for replacement of tyres for EV car?
- (a) ₹32,000
 (b) ₹24,000

- (c) ₹12,000
- (d) ₹16,000
- (iv) Calculate the operating cost of vehicle per month per car for CNG options.
- (a) ₹36,627.78
- (b) ₹24,000.50
- (c) ₹43,708.33
- (d) ₹16,605.55
- (v) Calculate the operating cost of vehicle per month per car for EV options
- (a) ₹36,627.78
- (b) ₹24,000.50
- (c) ₹43,708.33
- (d) ₹16,605.55

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(b)	2.	(a)	3.	(b)	4.	(b)	5.	(c)	6.	(a)
7.	(a)	8.	(a)	9.	(c)	10.	(d)				

Answers to the Theoretical Questions

1. Please refer paragraph 1
2. Please refer paragraph 2
3. Please refer paragraph 1

Answer to the Practical Problems

1. (i) Calculation of total project cost per day of concession period:

Activities	Amount (₹ in lakh)
Site clearance	170.70
Land development and filling work	9,080.35
Sub base and base courses	10,260.70
Bituminous work	35,070.80
Bridge, flyovers, underpasses, Pedestrian subway, footbridge, etc	29,055.60
Drainage and protection work	9,040.50
Traffic sign, marking and road appurtenance	8,405.00
Maintenance, repairing and rehabilitation	12,429.60
Environmental management	982.00
Total Project cost	114,495.25
Administration and toll plaza operation cost	1,120.00
Total Cost	115,615.25
Concession period in days (25 years × 365 days)	9,125
Cost per day of concession period (₹ in lakh)	12.67

(ii) Computation of toll fee:

Cost to be recovered per day = Cost per day of concession period + 15% profit on cost

$$= ₹12,67,000 + ₹1,90,050$$

$$= ₹14,57,050$$

$$\text{Cost per equivalent vehicle} = \frac{₹14,57,050}{76,444 \text{ units (Refer working note)}}$$

$$= ₹19.06 \text{ per equivalent vehicle}$$

Vehicle type-wise toll fee:

Sl. No.	Type of vehicle	Equivalent cost [A]	Weight [B]	Toll fee per vehicle [A×B]
1.	Two wheelers	₹ 19.06	1	19.06
2.	Car and SUVs	₹ 19.06	4	76.24
3.	Bus and LCV	₹ 19.06	6	114.36
4.	Heavy commercial vehicles	₹ 19.06	9	171.54

Working Note:

The cost per day has to be recovered from the daily traffic. The each type of vehicle is to be converted into equivalent unit. Let's convert all vehicle types equivalent to Two-wheelers.

Sl. No.	Type of vehicle	Daily traffic volume [A]	Weight	Ratio [B]	Equivalent Two-wheeler [A×B]
1.	Two wheelers	44,500	0.05	1	44,500
2.	Car and SUVs	3,450	0.20	4	13,800
3.	Bus and LCV	1,800	0.30	6	10,800
4.	Heavy commercial vehicles	816	0.45	9	7,344
	Total				76,444

2. Working Notes:**Total Distance (in km.) covered per month**

Bus route	Km. per trip	Trips per day	Days per month	Km. per month
Delhi to Chandigarh	250	2	8	4,000
Delhi to Agra	210	2	10	4,200
Delhi to Jaipur	270	2	6	3,240
				11,440

Passenger- km. per month

	Total seats available per month (at 100% capacity)	Capacity utilised		Km. per trip	Passenger-Km. per month
		(%)	Seats		
Delhi to Chandigarh & Back	800 (50 seats × 2 trips × 8 days)	90	720	250	1,80,000 (720 seats × 250 km.)
Delhi to Agra & Back	1,000 (50 seats × 2 trips × 10 days)	85	850	210	1,78,500 (850 seats × 210 km.)
Delhi to Jaipur & Back	600 (50 seats × 2 trips × 6 days)	100	600	270	1,62,000 (600 seats × 270 km.)
Total					5,20,500

Monthly Operating Cost Statement

	(₹)	(₹)
(i) Running Costs		
Diesel {(11,440 km ÷ 4 km) × ₹ 56}	1,60,160	
Lubricant oil {(11,440 km ÷ 100) × ₹ 10}	1,144	1,61,304
(ii) Maintenance Costs		
Repairs & Maintenance		1,000
(iii) Standing charges		
Salary to driver	24,000	
Salary to conductor	21,000	
Salary of part-time accountant	5,000	
Insurance (₹ 4,800 ÷ 12)	400	
Road tax (₹ 15,915 ÷ 12)	1,326.25	
Permit fee	315	
Depreciation {(₹ 12,00,000 × 20%) ÷ 12}	20,000	72,041.25

Total costs per month before Passenger Tax (i)+(ii)+(iii)		2,34,345.25
Passenger Tax*		93,738.10
Total Cost		3,28,083.35
Add: Profit*		1,40,607.15
Total takings per month		4,68,690.50

*Let, total takings be X then

$$X = \text{Total costs per month before passenger tax} + 0.2 X (\text{passenger tax}) + 0.3 X (\text{profit})$$

$$X = ₹ 2,34,345.25 + 0.2 X + 0.3 X$$

$$0.5 X = ₹ 2,34,345.25 \text{ or, } X = ₹ 4,68,690.50$$

$$\text{Passenger Tax} = 20\% \text{ of } ₹ 4,68,690.50 = ₹ 93,738.10$$

$$\text{Profit} = 30\% \text{ of } ₹ 4,68,690.50 = ₹ 1,40,607.15$$

Calculation of Rate per passenger km. and fares to be charged for different routes

$$\begin{aligned} \text{Rate per Passenger-Km.} &= \frac{\text{Total takings per month}}{\text{Total Passenger-Km. per month}} \\ &= \frac{₹ 4,68,690.50}{5,20,500 \text{ Passenger - Km.}} = ₹ 0.90 \end{aligned}$$

Bus fare to be charged per passenger.

Delhi to Chandigarh	=	₹ 0.90 × 250 km	=	₹ 225.00
Delhi to Agra	=	₹ 0.90 × 210 km	=	₹ 189.00
Delhi to Jaipur	=	₹ 0.90 × 270 km	=	₹ 243.00

3. Calculation of relative costs of three proposals and their ranking

	per annum (₹)	I Use of company's car per km. (₹)	II Use of own car per km. (₹)	III Use of hired car per km. (₹)
Reimbursement		--	10.00	9.00*
Fixed cost:				
Insurance	1,200	0.06	0.06	--
Taxes	800	0.04	--	0.04
Depreciation (₹ 6,00,000 - ₹80,000) ÷ 5 year	1,04,000	5.20	--	--
Running and Maintenance Cost:				
Petrol	--	6.00	--	6.00
Repairs and Maintenance	--	0.20	--	--
Tyre	--	0.12	--	0.12
Total cost per km.	--	11.62	10.06	15.16
Cost for 20,000 km.		2,32,400	2,01,200	3,03,200
Ranking of proposals		II	I	III

* (₹ 1,80,000 ÷ 20,000 km.)

The Second alternative i.e., use of own car by the executive and reimbursement of expenses by the company is the best alternative from company's point of view.

4. Cost Statement of Chambal Thermal Power Station

Total units generated 10,00,000 kWh.

	Per annum (₹)	Per kWh. (₹)
Fixed costs:		
Plant supervision	3,00,000	
Administration overheads	20,00,000	
Depreciation (5% of ₹ 2,00,00,000 p.a.)	10,00,000	
Total fixed cost: (A)	33,00,000	3.30

Variable costs:		
Operating labour	15,00,000	
Lubricants, spares and stores	4,00,000	
Repairs & maintenance	5,00,000	
Coal cost (Refer to working note)	8,50,000	
Total variable cost: (B)	32,50,000	3.25
Total cost [(A) + (B)]	65,50,000	6.55

Working Note:

Coal cost (10,00,000 kWh. ÷ 5 kWh) × ₹ 4.25 per kg. = ₹ 8,50,000

ANSWERS TO THE CASE SCENARIOS

1.

i.	(d)	ii.	(a)	iii.	(d)	iv.	(a)	v.	(c)
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(i) (d) ₹12,00,000

Calculation of Depreciation per month:

	Particulars	CNG Car	EV Car
A	Car purchase price (₹)	9,20,000	15,20,000
B	Less: Govt. subsidy (₹)	--	(1,50,000)
C	Less: Residual value (₹)	(95,000)	(1,70,000)
D	Depreciable value of car (₹) [A-B-C]	8,25,000	12,00,000
E	Life of the car	15 years	10 years
F	Annual depreciation (₹) [D÷E]	55,000	1,20,000
G	Depreciation per month (₹) [F÷12]	4,583.33	10,000

(ii) (a) ₹1,425

Fuel/ Electricity consumption cost per month:

	Particulars	CNG Car	EV Car
A	Average distance covered in a month (KM)	1,500	1,500

B	Mileage (KM)	20	240
C	Qty. of CNG/ Full charge required [A÷B]	75 kg.	6.25
D	Electricity Consumption [C×30kwh]	-	187.5
E	Cost of CNG per kg (₹)	60	-
F	Power cost per Kwh (₹)	-	7.60
G	CNG Cost per month (₹) [C×E]	4,500	-
H	Power cost per month (₹) [D×F]	-	1,425

(iii) (d) ₹16,000

Amortised cost of Tyre replacement:

	Particulars	CNG Car	EV Car
A	Life of vehicle	15 years	10 years
B	Replacement interval	5 years	5 years
C	No. of time replacement required	2 times	1 time
D	Cost of tyres for each replacement (₹)	16,000	16,000
E	Total replacement cost (₹) [C×D]	32,000	16,000
F	Amortised cost per year (₹) [E÷A]	2,133.33	1,600
E	Cost per month (₹) [F÷12]	177.78	133.33

(iv) (a) ₹ 36,627.78

(v) (c) ₹ 43,708.33

Amortised cost of Battery replacement:

	Particulars	CNG Car	EV Car
A	Life of vehicle	15 years	10 years
B	Replacement interval	8 years	8 years
C	No. of time replacement required	1 time	1 time
D	Cost of battery for each replacement (₹)	12,000	5,40,000
E	Total replacement cost (₹) [C×D]	12,000	5,40,000
F	Amortised cost per year (₹) [E÷A]	800	54,000
E	Cost per month (₹) [F÷12]	66.67	4,500

Calculation of Operating cost per month

	Particulars	CNG Car (₹)	EV Car (₹)
A	Running cost:		
	Fuel cost/ Power consumption cost [Refer WN-2]	4,500	1,425
B	Maintenance cost:		
	Annual Maintenance cost [Annual cost ÷ 12]	666.67	433.33
	Annual Insurance cost [Annual cost ÷ 12]	633.33	1,216.67
	Amortised cost of Tyre replacement [Refer WN-3]	177.78	133.33
	Amortised cost of Battery replacement [Refer WN-4]	66.67	4,500
		1,544.45	6,283.33
C	Fixed cost:		
	Depreciation [Refer WN-1]	4,583.33	10,000
	Driver's salary	20,000	20,000
	Garage rent	4,500	4,500
	Share of Office & Administration cost	1,500	1,500
		30,583.33	36,000
D	Operating cost per month [A+B+C]	36,627.78	43,708.33