PAPER – 5: STRATEGIC COST MANAGEMENT AND PERFORMANCE EVALUATION

*Question No.**1** is compulsory.*

*Answer any **four** questions from the remaining **five** questions.*

Working notes should form part of the answer.

No statistical or other table will be provided with this question paper.

Question 1

Cure Hospital is running under private-public-partnership (PPP) model - providing treatment for non-communicable diseases. ABCO Hospitals Limited is the private partner which runs a chain of hospitals on profit basis in major cities in India. The public partner is the State Government. Cure Hospital is a "not- for-profit" hospital.

Private partner is to invest in Upgrading and equipping the facility and responsible for operational management and service delivery. Government to provide physical space and other infrastructure in "as is where is" condition, provide support facilities and hospital amenities. Private partner assumes the entire responsibility, for a full range of investment operation and maintenance functions. Private partner has the authority to make daily management decisions.

The hospital is funded to a great extent by the State Government and a fixed level of funding is received from the government each year out of the State budgetary allocation. It is up to the hospital to allocate this fund to different areas such as doctors' and other staff salaries, medicines and all other costs required to run a hospital.

Cure Hospital's objectives are:

- *to give prompt access to high quality medical treatment for patients.*

- *to provide free treatment to poor patients in line with government policy of inclusive development.*

- *to provide value for money for the taxpayer-measured by the 3 Es framework of Economy, Efficiency and Effectiveness.*

- *to contribute to medical science by developing innovative ways to deliver treatment to patients.*

Except select surgeries, all services are free for poor patients that are below poverty line (BPL) card holders. 40% beds are reserved for poor patients. Free out patient department (OPD) services to poor. CT Scan and MRI diagnostics are free for poor patients, subsidised rates for others. Cure Hospital also runs a generic medicine shop inside the hospital premises which sells medicines to all patients at discount ranging from 40% to 56% - the only shop of this kind in the city.

WHO has agreed to provide financial and technical support to the neonatal care unit. The hospital enabled it to obtain five accreditation certificates from various leading authorities on different aspects of hospital management.

Feedback is taken from each in-patient about the quality of service provided by the hospital and the satisfaction level is taken in 1 to 10 point scale. 1 being the least satisfied and 10 represents totally satisfied.

In a recent meeting of the managing committee of the hospital, discussions were held about inadequate performance measurement systems in place to assess whether the hospital is achieving its objectives and that insufficient attention is given to the importance of non-financial performance indicators.

A four member team consisting of a performance management expert and three senior doctors was created to give their advice in these aspects.

The four member team met with doctors, staff and other stakeholders at length and breadth. Some of the conversations were as below:

Doctor A: I think the hospital always deliver value for money. We have always achieved our total financial budgets.

Doctor B: We work here much longer hours than doctors in other hospitals, often without being paid for working overtime.

Doctor C: There is not enough government and private partner funding to recruit more doctors and paramedic staff.

Doctor D: Number of out-patients has increased considerably. Earlier an out-patient had to wait for an average period of 2 hours 20 minutes and now the same has increased to 3 hours.

Senior Doctor K: I do not know how much time we spend developing innovative ways to deliver treatment to patients though, as most of the performance data we doctors receive relates to financial targets.

In-patient H: Incompetent paramedic staff, poor quality of food and bed linen.

Staff M: Management undermines our role in running the hospital.

Recent performance data of the hospital vis-a-vis national average are as follows:

	Cure Hospital	*National average of other PPP run hospitals*
Number of doctors	*80*	*76*
Average doctors' salaries per month including overtime	*₹1,20,000*	*₹1,60,000*
Average doctors' salaries including overtime as per budget	*₹1,20,000*	*₹1,25 000*
Number of in-patients treated	*8,360*	*6,369*
Average satisfaction rating of in- patients	*6*	*9*

Number of patients readmitted for treatment of the same ailment within short period of time after discharge from the hospital	627	128
Average staff satisfaction rating (0% represents totally dissatisfied and 100% represents totally satisfied)	16%	86%
Number of out-patients treated	76,212	63,318

Required

(a) EXPLAIN why non-financial performance indicators are particularly important to measure the performance of "not-for-profit" organisations such as Cure Hospitals.   **(4 Marks)**

(b) EVALUATE whether Cure Hospital is delivering value for money for each of the components of the value for money framework.   **(12 Marks)**

(c) The CEO of the hospital intends to introduce a nominal fee for out-patient treatment given to poor patients and remove subsidised rate of CT Scan and MRI diagnostic for other patients in order to achieve its objectives in a better way. EVALUATE the proposal of the CEO.   **(4 Marks)**

Answer

(a) Cure Hospital has been formed in a public-private partnership to provide quality healthcare to the public, with *focus on the poorer sections of the society*. Healthcare service is provided for free, except for select surgeries. A sufficient portion of its capacity (hospital beds) is reserved entirely for Below Poverty Line (BPL) patients. Generic medicines are provided at a discounted price, to make them more affordable. World Health Organization (WHO) has decided to fund its neo-natal unit. With all this information, it can be summarized that Cure Hospital has been formed "not-for-profit" objective, attending to a social cause of providing quality healthcare to the economically poorer sections of the society.

Cure Hospital has been formed in partnership with ABCO Hospitals Ltd. and the State Government. The State Government has provided physical space, infrastructure, other support facilities and hospital amenities. ABCO Hospital, the private partner has the entire responsibility of taking care of allocation of funds, investment, operations, and maintenance functions. Daily management decisions are also handled by the private partner.

Since the Government has provided substantial funding and facilities to Cure Hospital, it owes a fiduciary responsibility of reporting the financial measures to its stakeholders, the government in this case. At the same time, financial measures alone are not enough to assess the performance of not-for-profit organizations. Due to its objective of public service, measurement of appropriate non-financial metrics are equally important. The reasons are:

(i)   Benefits cannot be quantified: Cure Hospital essentially provides public healthcare service to the economically weaker sections of the society. Due to political, legal, and social reasons, not-for-profit organizations like Cure Hospital cannot be shut down merely for not being economically / financially viable. Therefore, financial measures are less relevant. Due to its non-financial objective, appropriate non-financial measures become more important. For example, the benefits of saving lives cannot be quantified in financial terms.

(ii)   Benefits may accrue over long term: The expenditure incurred in one year may yield benefits over several years. For example, the investment in an Intensive Care Unit (ICU) facility may accrue of multiple years. Neonatal care unit have been given financial and technical support from WHO which will give long term benefits to hospital.

(iii) Measurement of utilization of funds and expenditure: In the case of Cure Hospitals, many hospital services are free, allocation of capacity is aimed at providing free service to the BPL section of the society, medicines are provided at discounted rates. Therefore, Cure Hospital does not have a substantial revenue stream to earn from its patients. It gets a fixed budget allocation from the State Government, while ADCO Hospital allocates these funds for various investments and expenditures. *The assessment whether the spending have been appropriate is a key challenge.* Defining cost per unit would be subjective since it could be cost of patients arriving at the hospital or cost of patients successfully treated at the hospital. Either figure could be tweaked to make it seem that the objectives are being met. The management may resort to rampant spending simply to meet the expenditure targets. Therefore, non-financial measure need to be put in place help stakeholders scrutinize whether the objectives for which funds have been given are being met.

(iv)   Multiple objectives: Not-for-profit organizations have multiple objectives. It may be unclear which are the most important. Cure Hospital aims at providing high quality treatment to its patients while also developing innovative ways to deliver treatment to its patients. Both objectives are equally important and inter-related. Non-financial measures provide better information about how each of these objectives have been met.

The benefits of organizations like Cure Hospital are non-financial in nature. Except for providing fiduciary information to the stakeholders, all other objectives of Cure Hospital can be measure only using non-financial measures.

(b) Value for money for Cure Hospital would comprise of the 3Es: Economy, Efficiency and Effectiveness.

(i)   Economy: Has the desired output (and quality of service) been achieved at the lowest cost?

The medical resource at Cure Hospital in terms of doctors is 80, higher than the national average of 76 at other centers. Doctor's salaries would be a significant expenditure for Cure Hospital. **The average doctor's salary at Cure Hospital (including overtime) is ₹120,000 per month, this is within the budget figure as pointed out by Doctor A. The salary is lower than the national average at other PPP run hospitals, where doctors earn ₹160,000 per month.** Therefore, *economy of money is being achieved at Cure Hospital*.

The relatively lower levels of salary could be due to differences in levels of experience or that the doctors at Cure Hospital work overtime without getting paid (as pointed out by Doctor B). **This may be one of the reasons why staff satisfaction is only 16% compared to 86% in other centers.**

(ii)   Efficiency: Has maximum output been achieved with the minimum resources?

Treating patients is the key objective of Cure Hospitals, while doctors are the main resource to deliver it. The number of patients treated per year is a good measure of efficiency achieved.

Cure Hospital treats 84,572 patients (in house patient 8,360 + outpatient 76,212) while the national average at other centers is only 69,687 (in house patient 6,369 + outpatient 63,318). Cure Hospital has 80 doctors as compared to 76 national average. Therefore, each doctor at Cure Hospital **treats 1,057 patients (84,572 patients/ 80 doctors) as compared to 917 patients** (69,687 patients / 67 doctors) at other centers. *Resource utilization of its pool of doctors is higher in Cure Hospital.*

Doctor C mentions that there is not enough funding to hire more doctors and para-medic staff. Therefore, there is a constraint on the limited resources of doctors and support staff. This might be the reason, why each doctor at Cure Hospital works longer than colleagues at other centers.

Therefore, while efficiency in terms of number of patients treated by each doctor is high, there are other *hidden costs* that need to be taken into account. **Few such costs could be low employee morale, higher waiting time of patients to receive treatment.** This impacts the effectiveness of service provided.

(iii)   Effectiveness: Has Cure Hospital achieved its mission or objective?

Cure Hospital has the objective of providing high quality medical service to its patients. Better quality of treatment would ensure that re-admission for treatment of the same ailment within a short span of time would be minimal. **Number of such re-admitted patients in much higher at 627 at Cure Hospital as compared to 128 at other centers.** Assuming all such re-admissions to be in-house patients, this return of patients for medical care for the same ailment within a short span of time is **7.50%** compared to the national average of **2.01%**.

Prompt medical treatment can also be questioned since the **waiting time of patients to receive treatment has increased from 2 hours 20 minutes to 3 hours.**

Senior Doctor K points out the time spent on delivering innovative care to patients may be limited due to financial constraints and overwork staff.

All this would have resulted in dissatisfaction among patients, whose **survey indicates a score of 6 against a national average of 9.** This shows that *objective of Cure Hospital is not being met effectively.*

To summarize, *Cure Hospital is achieving economy by maintaining lower salaries for doctors. Out-reach to patients is also high as compared to national average. However, due to limited availability of resources, doctors and staff are* **overworked***. While it does well on the efficiency aspect, it comes with a hidden cost in terms of* **dissatisfaction among patients and employees and low quality of medical care.** *Therefore, medical treatment is not effective, which is an important aspect in the value for money framework.*

(c)   Proposal to introduce nominal fee for out-patient treatment given to poor people and remove subsidized rate of CT scan and MRI for other patients.

Cure Hospital is a not-for-profit organization that aims at providing quality health care to the economically weaker sections of the society. It gets its primary funding from the State Government. It does not generate and is not aimed at generating substantial revenue from its patients. The CEO has proposed to introduce nominal fee for out-patient treatment given to poor people and remove subsidized rate of CT scan and MRI for other patients. However, this would not help Cure Hospital achieve its objective.

The given problem seems to suggest severe constraint in the resources available to meet its objectives thus impacting effectiveness of treatment. Each doctor treats 1,057 patients in a month as compared to the national average of 917 in a month. Number of patients, especially the out-patients is much more than national average. **Overworked doctors combined with limited staff resources is the main hurdle that Cure Hospital faces in effectively achieving its objectives.**

Cure Hospital is a not-for-profit organization. **Therefore, generating nominal fees to achieve its objectives would not help its purpose. Instead, it *can apply for higher budget allocation from the government*.** This can help it procure good quality resources such as experienced doctors by paying them higher salaries including overtime. Better qualified doctors can help provide not just better treatment but also innovative ways of treatment to patients. Improved / enhanced facilities could reduce the waiting time for medical care, enabling prompt medical service.

Improved service would result in better treatment, lowering the cases for re-admissions for same ailment within a short span of time. This improves the effectiveness of medical care provided at Cure Hospital. Better service would improve patient satisfaction. Quality medical care would provide a better case for Cure Hospital to sustain its operations in the long- run. The State Government may also more favorably consider any justifiable future budgetary increments.

Overall, the management of the hospital seems to be indifferent to the opinions and needs of the staff. **The CEO's decision has a very short term outlook that does not co-relate with the organization's objectives.** By trying to off-set a limited revenue stream to achieve its objectives shows that the management's style of working needs improvement.

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> Conceptually correct *brief explanation* is sufficient for each step.

Question 2

Pixel Limited is a toy manufacturing company. It sells toys through its own retail outlets. It purchases materials needed to manufacture toys from a number of different suppliers. Recently, due to the entity of few reputed foreign brands in the toy market and particularly in the segment in which Pixel Ltd. is doing business, it is facing a threat to operate profitably.

Each toy requires 4 kg. of materials at ₹ 19 per kg. and 5% of all materials supplied by the suppliers are found to be substandard. Labour hour requirement for each toy is 0.4 hour at ₹ 120 per hour.

Market research has determined that the selling price will be ₹ 240 per toy. The company requires a profit margin of 15% of the selling price. Expected demand for toy in the coming year will be 50,000 toys. Sales and variable overhead per unit for the four quarters of the year will be as follows:

	Q1	Q2	Q3 (Festive season)	Q4 (Festive season)
Sales (units)	7,500	9,000	15,500	18,000 ·
Variable overhead per unit (₹)	22	22	24	25

Total fixed overheads are expected to be ₹ 6,25,000 for each quarter.

The production manager has decided to produce 12,500 units in each quarter. Inventory holding costs will be ₹ 18 per unit of average inventory per quarter. Inventory holding costs are not included in above.

Normal production capacity per quarter is 15,000 toys. The company can produce further up to 6,000 units per quarter by resorting to overtime working. Overtime wages will be at 150% of normal wage rate.

Assume zero opening inventory.

Required

(a) (i) CALCULATE the cost gap that exists between the total cost per toy as per the production plan and the target cost per toy.   **(9 Marks)**

(ii) *DISCUSS how just-in-time purchasing and just-in-time production will remove the cost gap calculated in (i) above. Show calculations in support of your answer.*   **(7 Marks)**

(b) *EXPLAIN, how implementation of JIT production method can be a major source of competitive advantage and success of the company.*   **(4 Marks)**

Answer

(a) (i) Cost gap between Total Cost *per toy* as per the production plan and the Target Cost *per toy*

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Target Cost *per toy*

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Sr. No.	Particulars	₹ per unit	For Annual Sales of 50,000 units
1	Selling Price *per toy*	240	1,20,00,000
2	Required Profit Margin (15% of selling price =15% ×₹240 *per unit*)	36	18,00,000
3	Target Cost *per annum* (Step 1 - 2)		1,02,00,000
4	Target Cost *per toy* (Step 3 / 50,000 units)		**204.00**

Therefore, Target Cost is **₹204** *per toy*.

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Total Cost as per production plan

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Pixel Ltd. has an annual production requirement of 50,000 toys, which is also its annual sales. Given that opening inventory for the first quarter is nil. The production manager wants to produce 12,500 units *per quarter* irrespective of the sales demand for the quarter. This implies that during some quarters, there might be unsold inventory, for which inventory holding cost has to be borne. This type of production is called "produce to stock".

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Production Schedule and Inventory Holding Cost *for the year*

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Sr. No.	Particulars	Q1	Q2	Q3	Q4	Total for the year
1	Opening Stock (units)	-	5,000	8,500	5,500	
2	Production (units)	12,500	12,500	12,500	12,500	50,000
3	Sales (units)	7,500	9,000	15,500	18,000	50,000
4	Closing Stock (units) (Step 1 + 2 – 3)	5,000	8,500	5,500	-	

5	Average Inventory = (Step 1+ Step 4)/ 2	2,500	6,750	7,000	2,750	
6	Inventory Holding Cost (Average Inventory × ₹18 *per unit* of Average Inventory)	₹45,000	₹1,21,500	₹1,26,000	₹49,500	**₹3,42,000**

Total Cost of Production *per toy* as per production plan

Sr. No.	Particulars	Q1	Q2	Q3	Q4	Total for 50,000 units
1	Direct Material Cost *per unit* (Note 1)	₹80	₹80	₹80	₹80	₹40,00,000
2	Direct Labour Cost *per unit* (Note 2)	₹48	₹48	₹48	₹48	₹24,00,000
3	Variable Overhead Cost *per unit*	₹22	₹22	₹24	₹25	₹11,62,500
4	Total Variable Cost *per unit* for the quarter (other than inventory holding cost) [Steps 1+ 2+3]	₹150	₹150	₹152	₹153	
5	Production (units) for the quarter (refer production schedule above)	12,500	12,500	12,500	12,500	50,000
6	Total Variable Cost for the quarter (other than inventory holding cost) [Step 4 × Step 5]	₹18,75,000	₹18,75,000	₹19,00,000	₹19,12,500	₹75,62,500

7	Inventory Holding Cost for the quarter (refer to the production schedule above)	₹45,000	₹1,21,500	₹1,26,000	₹49,500	**₹3,42,000**
8	Fixed Overheads	₹6,25,000	₹6,25,000	₹6,25,000	₹6,25,000	₹25,00,000
9	Total Cost [Step 6 + Step 7+Step 8]	₹25,45,000	₹26,21,500	₹26,51,000	₹25,87,000	₹1,04,04,500
10	Total Cost per toy as per production schedule (Step 9 / 50,000 units)					**₹208.09**

Note 1

Each toy requires 4kg of material, 5% of all materials is substandard. Therefore, procurement should factor this substandard quality.

Material required *per unit* = 4 kg / 95% = 4.21 kg

Material Cost *per toy* produced = 4.21 kg ×₹19 per kg = ₹80 *per unit*

Note 2

Each toy requires 0.40 hours. Rate per hour is ₹120 *per hour*.

Therefore, Cost *per toy* = 0.40 × ₹120 = ₹48 *per unit*

Cost Gap

= Total Cost *per toy* as per production schedule – Target Cost *per toy*

= ₹208.09 - ₹204.00 *per toy*

= ₹4.09 per toy

JIT System

(ii) Just in Time Purchasing and Just in Time Production is aimed at eliminating inventory holding of raw material and finished goods respectively. Components are purchased only when there is a requirement in the production process. Similarly, finished goods are produced only when there is a demand for them. This type of production is called "produce to order". Hence, there is neither any opening inventory nor any closing inventory, thereby no inventory holding cost.

In the given problem, this savings is off-set by the extra payment to be made to labor for overtime. Production capacity is 15,000 toys per quarter. This can be increased by 6,000 toys per quarter by incurring additional overtime cost.

The Production Plan under the Just in Time System

Sr. No.	Particulars	Q 1	Q 2	Q 3	Q 4	Total for the year
1	Opening Stock (units)	-	-	-	-	
2	Production (units)	7,500	9,000	15,500	18,000	50,000
3	Sales (units)	7,500	9,000	15,500	18,000	50,000
4	Closing (units)	-	-	-	-	
5	Inventory Holding Cost	-	-	-	-	
6	Production Beyond Capacity of 15,000 Toys *per quarter* (units)	-	-	500	3,000	

Total Cost of Production under JIT System

Sr. No.	Particulars	Q1	Q2	Q3	Q4	Total for 50,000 units
1	Direct Material Cost *per unit* (Note 1)	₹76	₹76	₹76	₹76	38,00,000
2	Direct Labour Cost *per unit*	₹48	₹48	₹48	₹48	24,00,000
3	Variable Overhead Cost *per unit*	₹22	₹22	₹24	₹25	11,85,000
4	Total Variable Cost *per unit* (Steps 1+2+3)	₹146	₹146	₹148	₹149	
5	Production (units) for the quarter (Refer JIT production schedule above)	7,500	9,000	15,500	18,000	50,000
6	Total Variable Cost for the quarter (Step 4 × Step 5)	₹10,95,000	₹13,14,000	₹22,94,000	₹26,82,000	₹73,85,000
7	Production (units) for the quarter in excess of capacity (Refer JIT production schedule above)	-	-	500	3,000	3,500

8	Overtime Labour Cost for production in excess of capacity (Note 2) [Step 7 × 0.40 × 50% ×₹120 per hour]	₹0	₹0	₹12,000	₹72,000	**₹84,000**
9	Fixed Overheads	₹6,25,000	₹6,25,000	₹6,25,000	₹6,25,000	₹25,00,000
10	Total Cost for production under the JIT System (Step 6 + Step 8+ Step 9)	₹17,20,000	₹19,39,000	₹29,31,000	₹33,79,000	₹99,69,000
11	Total Cost *per toy* as per production schedule (Step 10 / 50,000 units)					**₹199.38**

Note 1

Carefully selected suppliers of delivering high quality materials in a timely manner directly at the shop floor, reducing the material receipt time and loss due to sub-standard material.

Note 2

Overtime wages are 150% of normal wage rate. Therefore, for every toy produced over the quarterly production capacity of 15,000 toys, 50% extra wage over and above the hourly rate has to be paid as overtime wages. Each toy needs 0.40 hours for production. Therefore, overtime cost for excess production = excess production units × 0.40× 50% ×₹120 per hour.

Cost Gap

The cost of production *per toy* under the JIT system is ₹199.38 per toy as compared to the target cost of ₹204 *per toy* and ***save ₹ 4.62 per toy***.

The savings *primarily* comes from eliminating the inventory holding cost of ₹3,42,000 per annum and sub- standard material cost of ₹2,00,000 per annum under the previous production system. This is slightly offset by the additional cost of ₹84,000 per annum that has to be paid towards overtime labor charges and ₹22,500 towards additional variable overheads. However, by switching to the JIT system, Pixel Ltd. could reduce its production cost below the target cost per toy.

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This question can also be solved by assuming "***continued*** material wastage" due to ***sub-standard material* from suppliers**.

(b) JIT system aims at:

- Meeting customer demand in a timely manner.
- Providing high quality products and
- Providing products at the lowest possible price.

The main features of the JIT production system are:

- **Material handling cost is reduced –** materials move from one machine to another in an organized sequence. The production process is grouped into to manufacturing cells. These can be managed with *minimal labor*. This reduces material handling costs as also any pile up of inventory in the form of work-in-progress. In JIT procurement process, the raw material is received only when needed. *Due to significant reduction in inventory, inventory holding costs, normal wastage cost and spoilage can be avoided. Optimum arrangement of cells can lead to lesser floor space requirement, thereby reducing factory rental and overhead cost.*

- **Multi-skilled labor:** Hire and retain multi-skilled workers who are capable of performing a variety in operations including repairs and maintenance. Therefore, a worker is not confined to only one process in the production process. He can contribute towards other processes as well. This reduces the workforce requirement and labor idle time. The company can have a *more efficient workforce, with lesser number of workers*. There is potential to reduce labor cost on account of this.

- **Minimizing defects rework and scrap**: Each stage of the production process is tightly linked in a sequential manner. Defective output from one stage will stop the work at the next stage. Due to this, workers can identify and correct errors or defects instantaneously. JIT creates urgency for eliminating defects as quickly as possible since the downstream work also stops due to error in any workstation. *Production process efficiency improves and reduces rework or scrap.* The overall quality of production improves. There are other benefits to streamlining production process: *lesser need for inspection of final output and lesser sales returns due to defects. This would contribute to the product's brand value.*

- **Reduced set-up time:** Streamlined production process under JIT *reduces set-up time at the workstations*. When the production process has to change to make the product per the customers' demands, set-up time is incurred at the workstation. By streamlining operations, JIT system aims at reducing the set-up time, so that production can continue with the least possible interruption. This brings flexibility in the operations since the company can quickly change the production requirement, to make products to meet the customer's demand. Quick turnover improves productivity of the machine, thereby increasing the production capacity. Lesser time is spent on set-up which is not a value adding activity.

- ▪ **Reduces lead time for receiving materials** since the suppliers of raw material are capable of delivering high quality materials in a timely manner directly at the shop. Proper selection of such suppliers is imperative for the JIT system to be successful. If this can be achieved, then it is beneficial for the company since inventory holding of material is eliminated along with receiving *better quality of raw material in a timely manner*.

Eliminating inventory holding, scrap, material wastage, flexibility in operations by reducing set-up time, better response time to customer's demands, better skilled workforce, better quality of production, lower workforce requirement, lower floor space requirement all of these contribute towards lowering working capital requirements. These contribute to a company's competitive edge and success.

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> Conceptually correct brief explanations are sufficient.

Question 3

AKG Limited has three autonomous divisions. The divisions are evaluated on the basis of ROI, with year end bonuses given to divisional managers who have the highest ROI. Operating results of Division II for the last year are given below:

	₹
Sales	2,10,00,000
Less: Variable Expenses	1,26,00,000
Contribution margin	84,00,000
Less: Fixed Expenses	67,20,000
Net Operating Income	16,80,000
Divisional Operating Assets	52,50,000

The company's overall ROI for the last year was 18% (considering all divisions). Division II has an opportunity to add a new product line that would require an investment of ₹30,00,000. Other details of the new product line are as follows:

	₹
Sales	₹90,00,000 per annum
Variable Expenses	65% of sales
Fixed Expenses	₹25,20,000 per annum
Life cycle of the product line	5 years

Though Division II is performing well, but many a times, the customers complained that they had to wait for long after placing the orders. The company is interested in cutting the amount of time between when a customer places an order and when the order is completed. For the last year, the following data were reported in respect of Division II:

Inspection time	=	*0.5 days per batch*
Process time	=	*2.8 days per batch*
Wait time	=	*16.0 days per batch*
Queue time	=	*4.0 days per batch*
Move time	=	*0.7 days per batch*

In addition to financial performance measures, the company wishes to introduce a variety of non-financial performance measures.

The company has set aggressive targets in both sales growth and ROI for the coming year. The company's strategy for achieving these goals includes a campaign aimed at building brand recognition, customer retention, improvement in product quality, on time delivery to customers, expansion of eco-friendly product line and introduction of limited edition items.

Required:

(a) (i) CALCULATE last year's ROI of Division II. **(1 Mark)**

  (ii) DISCUSS whether the manager of Division II would accept or reject the new product line, if he takes his decision based solely on divisional ROI. **(2 Marks)**

  (iii) ADVISE how residual income approach can be used as an alternative financial measure for evaluation of managerial performance in the best interest of the company. **(2 Marks)**

  (iv) CALCULATE Manufacturing Cycle Efficiency (MCE) and interpret the result. **(3 Marks)**

  (v) STATE what percentage of the production time is spent in non-value added activities.

  (1 Mark)

  (vi) CALCULATE the delivery cycle time. **(1 Mark)**

  (vii) CALCULATE the new MCE if by using Lean Production all queue time can be eliminated. **(2 Marks)**

(b) *Based on the above information and using a Strategy Map TABULATE two objectives and two measures for each perspective across the four dimensions of a balanced scorecard in the following format :*

Perspective	Strategic Objective	Measure

(8 Marks)

Answer

(a) (i)   Calculation of last year ROI of Division II

= Controllable Profit/ Controllable Net Asset

= ₹16,80,000/ ₹52,50,000

= 32%

(ii) Calculation of ROI of New Product Line

Particulars	Amount (₹)
Sales	90,00,000
Less: Variable Cost	58,50,000
Controllable Contribution	31,50,000
Less: Fixed Cost	25,20,000
Controllable Profit	6,30,000
Investment Available	30,00,000
Return on the Proposed Line (ROI)	**21%**

The manager of Division II would be unwilling to invest the additional ₹30 lacs because this would decrease the Division II's ROI of 32% to 28%.

[₹16,80,000+₹6,30,000/ (₹52,50,000+₹30,00,000)]

(iii) Generally, a manager who is evaluated based on ROI will reject any project whose rate of return is below the Division's current ROI even if the rate of return of the project is above the company's minimum required rate of return. In contrast, managers who are evaluated using residual income will pursue any project whose rate of return is above the minimum required rate of return, because it will increase their residual income. So, in the best interest of the company as a whole, residual income approach can be used for evaluation of managerial performance.

Alternative

To overcome some of the dysfunctional consequences of ROI, the residual income approach can be used. For the investment decision for Divisions II, the residual income calculations are as follows:

Proposed Investment	₹ 30,00,000
Controllable Profit	₹6,30,000
Cost of Capital (18%)	₹5,40,000
Residual Income(RI)	**90,000**

Advise

This calculation indicates that the residual income of Division II will increase if manager accept the project. However, it is important to note that Residual Income does not always point to the right decision, because notional interest on accounting capital employed is not the same as IRR on cash investment. This Project has 1.65% IRR.

Overall, Residual Income is more likely than ROI to improve when managers make correct investment decisions, and so is probably a 'safer' basis than ROI on which to measure performance.

(iv) Manufacturing Cycle Efficiency (MCE)

$$= \frac{\text{Processing Time}}{\text{Inspection Time} + \text{Process Time} + \text{Queue Time} + \text{Move Time} + \text{Wait Time}}$$

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days} + 16.0 \text{ days}}$$

$$= 11.67\%$$

Interpretation

In AKG, the MCE is 11.67%, which means that 88.33% of the time a unit is in process is spent on the activities that do not add value to the product. Monitoring the MCE helps companies to reduce non -value added activities and thus get products into the hands of customers more quickly and at a lower cost.

(v) Percentage of Time Spent on Non- Value Added Activities

$$= 100\% - 11.67\%$$

$$= 88.33\%$$

(vi) Delivery Cycle Time

$$= 0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days} + 16 \text{ days}$$

$$= 24 \text{ days}$$

(vii) Revised MCE

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 0 \text{ days} + 0.7 \text{ days} + 16 \text{ days}}$$

$$= 14\%$$

Alternative (iv) to (vii)

(iv)   **Manufacturing Cycle Efficiency (MCE)**

$$= \frac{\text{Value Added Time (Processing Time)}}{\text{Throughput (Manufacturing Cycle) Time}}$$

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 4.0 \text{ days} + 0.7 \text{ days}}$$

= 35%

Interpretation

In AKG, the MCE is 35%, which means that 65% of the time a unit is in process is spent on the activities that do not add value to the product. Monitoring the MCE helps companies to reduce non -value added activities and thus get products into the hands of customers more quickly and at a lower cost.

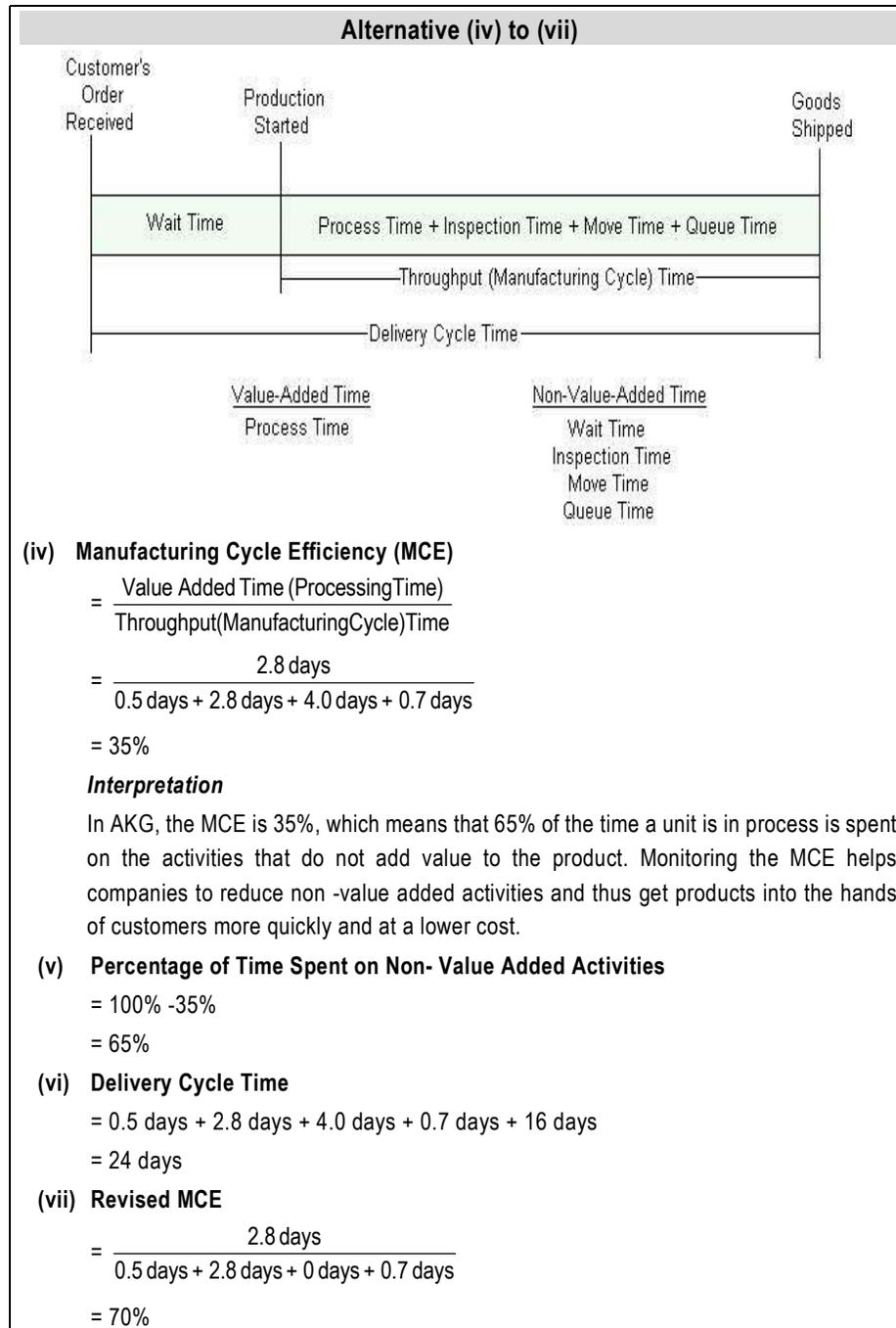(v)   **Percentage of Time Spent on Non- Value Added Activities**

= 100% -35%

= 65%

(vi)   **Delivery Cycle Time**

= 0.5 days + 2.8 days + 4.0 days + 0.7 days + 16 days

= 24 days

(vii) **Revised MCE**

$$= \frac{2.8 \text{ days}}{0.5 \text{ days} + 2.8 \text{ days} + 0 \text{ days} + 0.7 \text{ days}}$$

= 70%

(b)

Perspective	Strategic Objective	Measure
Financial	- Improve ROI - Increase Sales	% increase in ROI % increase in sales
Customer Perspective	- Improve brand recognition - Customer retention	% of target audience who recognize brand %of suggestions/ complaints responded % increase in repeat customers/ Number of repeat customers
Internal Perspective	- Improve in product quality - Improve on time delivery to customers - Reduction in time spent in non-value added activities	% reduction in defect rate % of orders on time % increase in MCE
Learning & Innovation	- Expansion of eco-friendly product line - Introduction of limited edition items	- No of eco-friendly products developed. - No of limited editions introduced.

☞

Other measures are also possible.

Question 4

(a) *A chemical company produces two chemicals SX and ZX. Environmental activities and costs associated with the two chemicals are as follows :*

	SX	**ZX**
Unit produced (kg.)	6,00,000	15,00,000
Packing Materials (kg.)	80,000	40,000
Energy Usage (KWH)	60,000	30,000
Toxin releases (Pounds into air)	2,00,000	40,000
Pollution control machine hours	32,000	8,000

Cost of environmental activities :	
Packing material Costs	₹ 3,60,000
Energy Costs	₹ 96,000
Fines for release of toxins into air	₹ 48,000
Operating costs of pollution control equipments	₹ 1,12,000

Required

CALCULATE the environmental cost per kilogram for each chemical produced by the company.   **(5 Marks)**

OR

The triple bottom line recognises that a company's performance should not only be viewed in terms of its ability to generate economic profits for its owners, but also by its impact on people and the planet for its long term economic and social viability. XYZ Limited has recently undertaken initiatives towards sustainability as below :

(i)   Reduced the amount of plastic usage in the peanut butter jars.

(ii)   Provided financial support to hospital run by local authority in the vicinity of the factory.

(iii)   Constructed solar powered warehouse.

(iv)   Generate profit for the company's shareholders.

(v)   Started child care unit for the benefit of women employees as well as for the neighborhood community.

Required

IDENTIFY whether this initiative would primarily impact people, planet or profit. **(5 Marks)**

(b)   The President of Automation Limited, a 150 persons engineering company, decided it was time to fire the company's biggest client. Although the client provided close to 60% of the company's annual revenue, Automation Limited decided that dropping this client was necessary. The client was profitable.

The President of Automation Limited stated "We cannot be a great place to work without employees, and this client was bullying my employees. Its demands for turnaround were impossible to meet even with people working seven days a week. No client is worth losing my valued employees".

The initial impact on revenues was significant. However, Automation Limited was able to cut costs and obtain new customers to fill the void. Moreover, the dropped client later gave Automation Limited two projects on more equitable terms.

Required

(i)   DISCUSS the reasons behind dropping of a profitable client by Automation Limited.

(2 Marks)

(ii) STATE three qualitative factors that management should consider in outsourcing and make or buy decisions.   **(3 Marks)**

(c) APC Ltd. has two divisions- Division X and Division Y with full profit responsibility. Division X produces components 'Gex' which is supplied to·both division Y and external customers.

Division Y produces a product called 'Gextin' which incorporates component 'Gex'. For one unit of 'Gextin' two units of component 'Gex' and other materials are used.

Till date, Division Y has always bought component 'Gex' from division X at ₹ 50 per unit since the lowest price at which the component 'Gex' could have been bought by Division Y was ₹52 per unit.

Division X charges the same price for component 'Gex' to both division Y and external customers. However, it does not incur selling and distribution costs when transferring internally.

Division Y has received a proposal from a new supplier who has offered to supply component 'Gex' for ₹ 47 per unit at least for the next three years.

Manager of Division Y requests the manager of Division X to supply component 'Gex' at or below, ₹ 47 per unit. Manager of Division X is. not ready to reduce· the transfer price since the divisional performance evaluation is done based on profit margin ratio of the division.

The following additional information is made available to you :

	Component 'Gex' ₹	Product 'Gextin' ₹
Selling Price per unit	50	180
Less: Variable Costs		
Direct Materials		
Component 'Gex'	-	100
Other materials	12	22
Direct labour	16	13
Manufacturing Overhead	2	5
Selling and Distribution Costs	4	2
Contribution per unit	16	38
Annual fixed costs	₹ 40,00,000	₹ 20,00,000
Annual external demand (units)	3,00,000	1,20,000
Capacity of plant (units)	5,00,000	1,50,000

Required

(i) *CALCULATE the present profit of each division and the company as a whole.* **(2 Marks)**

(ii) *ANALYSE the impact on the total annual profits of each division and the company as a whole if Division Y accepts the offer of the new supplier.* **(4 Marks)**

(iii) *In the changed scenario, DISCUSS why the top management should intervene and advise a suitable transfer price for component 'Gex' for resolving transfer pricing conflict which promotes goal congruence through efficient performance of the concerned division.* **(4 Marks)**

Answer

(a) Environment Cost Allocation

Allocation of environment costs incurred by the company can be allocated to products using (i) Input-Out analysis (ii) Flow Cost Accounting (iii) Life cycle costing and (iv) Activity Based Costing

Environment costs can be allocated to Chemicals SX and ZX using Activity Based Costing.

S. No.	Type of Environment cost	Allocation Basis	Cost Allocation ₹		
			Chemical SX	Chemical ZX	Total
1	Packing Material Costs	*Packing Materials(kg.)* SX 80,000 kg. ZX 40,000 kg.	2,40,000	1,20,000	3,60,000
2	Energy Cost	*Energy Usage (KWH)* SX 60,000 kwh ZX 30,000 kwh	64,000	32,000	96,000
3	Fines for Release of Toxins into Air	*Toxins Released (Pounds into air)* SX 200,000 pounds ZX 40,000 pounds	40,000	8,000	48,000
4	Operating Costs of Pollution Control Equipment	*Pollution Control Machine Hours* SX 32,000 hrs ZX 8,000 hrs	89,600	22,400	1,12,000
5	Total Cost Allocation	Sum of Steps 1 to 4	4,33,600	1,82,400	6,16,000
6	Units Produced (kg.)		6,00,000	15,00,000	21,00,000
7	Environment Cost *per unit* produced (Step 5 / Step 6)		₹0.7227	₹0.1216	₹0.2933

The environment cost allocation per kilogram for Chemical SX is ₹0.72 per kg and Chemical ZX is ₹0.12 per kg.

The average environment cost per kg for overall production is ₹0.2933 per kg.

Or

Triple Bottom Line

Identification of initiatives undertaken by XYZ Ltd. into categories it would impact based on the Triple Bottom Line Model – People, Planet or Profit.

Reduced the amount of plastic usage in peanut butter jars.	Planet
Provided financial support to hospital run by local authority in the vicinity of the factory	People
Constructed solar powered warehouse	Planet
Generated profit for the company's shareholders	Profit
Started child care unit for the benefit of women employees as well as for the neighboring community	People

(b)   Decision Making – Automation Ltd.

(i)   With increasing completion, dynamic market changes, changing needs of customers, *non-financial* and *ethical considerations* have gained relevance in the decision-making process. A company may face the dilemma of meeting customers' needs while protecting employees' rights. While there are no clear-cut parameters to measure the impact of such decisions, they have a <u>long-term impact on the company's operations that ensures profitability and sustainability of an organization</u>.

In the given scenario, a customer who contributes close to 60% of Automation Ltd.'s profits has been making turnaround demands that are unreasonable for the company employees to meet. Automation Ltd. has to decide whether to continue doing business with the customer based on the current terms or protecting the work environment of its employees. In the current scenario, *it is in Automation's <u>long term interests to protect its employees' rights (a non-financial consideration)</u>. Keeping this approach in mind, Automation Ltd. decided to terminate business with the profitable client. While this had a significant impact on revenues in the short term, <u>in the long run Automation Ltd. was able to get business from new clients.</u> Also, realizing the <u>value of service</u> provided, the dropped client came back with projects on equitable terms.* Therefore, even though it did not make financial sense in the short run, decisions based on non-financial metrics played an important role in ensuring Automation Ltd.'s long term sustainability.

☞

Conceptually correct brief explanation is sufficient.

(ii) Qualitative factors to consider while making the outsourcing and make or buy decisions:

(a) Quality of goods produced outside vs. in-house production of the component. Outsourcing or buying a component from the external market, should not impact the overall quality of the product. Therefore, *any component critical for a product would generally not be outsourced unless its supplier gives quality assurance*.

(b) *Reliability of suppliers* in the outsourcing arrangement. Assurance must be given by the supplier in terms of both quality and timely delivery of components for the given price. Also, there must be a sufficient pool of suppliers from whom the company can buy the product. If one supplier closes shop, there must be alternate suppliers available.

(c) *Availability of skilled labor and infrastructure* to make the component in-house. If not available, then the component may have to be bought from the external market.

(d) *Regularity of demand for the product* – If made in-house, seasonal demand for a product may result in the risk of holding high inventories (including that of raw materials) or making high capital investments that will prove unproductive during off-season. Therefore, *outsourcing or buying from external market may be more viable when the demand for the final product is seasonal*.

(e) *Risk of technological obsolescence for the component* – when the risk is higher company may favor outsourcing.

(f) *Confidentiality of process or patent of process* – Confidential processes or critical components may not be outsourced.

(g) The shutting down of company's manufacturing facility might have a negative impact on the morale of remaining employees.

(c) APC Ltd. Transfer Pricing

(i) Profitability of each division and the company as a whole when Division X supplies 240,000 units of Gex annually to Division Y.

Division Y produces 1,20,000 units of Gextin. Each component of Gextin requires 2 components of Gex that it currently procures from Division X. Therefore, it procures 2,40,000 units of Gex from Division X annually.

Division X has an overall capacity of 5,00,000 units annually to produce Gex. Of this it produces 2,40,000 units for Division Y, which it must first cater to. The remaining 2,60,000 units of Gex is sold to external customers.

Divisional and Overall Profitability of APC Ltd.

Sr. No.	Particulars	Division X				Division Y		Total APC Ltd
		Per unit of Gex	External Sales	Internal Sales	Total Division X	Per unit of Gextin	External Sales	
			2,60,000 units	2,40,000 Units	5,00,000 Units		1,20,000 units	
1	Selling Price	50	1,30,00,000	1,20,00,000	2,50,00,000	180	2,16,00,000	4,66,00,000
2	*Less:* Variable Cost							
a	Direct Material							
b	Component Gex	---	---	---	---	100	1,20,00,000	1,20,00,000
c	Other materials	12	31,20,000	28,80,000	60,00,000	22	26,40,000	86,40,000
d	Direct Labour	16	41,60,000	38,40,000	80,00,000	13	15,60,000	95,60,000
e	Manufacturing Over-head	2	5,20,000	4,80,000	10,00,000	5	6,00,000	16,00,000
f	Selling and Distribution Costs	4	10,40,000	----	10,40,000	2	2,40,000	12,80,000
	Total	34	88,40,000	72,00,000	1,60,40,000	142	1,70,40,000	3,30,80,000
3	Contribution (Step 1 - 2)	16	41,60,000	48,00,000	89,60,000	38	45,60,000	1,35,20,000
4	Annual Fixed Cost				40,00,000		20,00,000	60,00,000
5	Annual Profit (Step 3 - 4)				49,60,000		25,60,000	75,20,000

Note

Division X does not incur marketing costs on internal sales. Therefore, cost not incurred on transfer of 240,000 units to Division Y.

(ii) Impact if Division Y accepts to buy 240,000 units of Gex annually from the external supplier at ₹47 per unit of Gex.

Sr. No.	Particulars	Division X				Division Y		Total
		Per unit of Gex	External Sales	Internal Sales	Total Division X	Per unit of Gextin	External Sales	
			3,00,000 units	0 Units	3,00,000 units		1,20,000 units	
1	Selling Price	50	1,50,00,000	-	1,50,00,000	180	2,16,00,000	3,66,00,000
2	*Less:* Variable Cost							
a	Direct Material							
b	Component Gex	-	-	-	-	94	1,12,80,000	1,12,80,000
c	Other Materials	12	36,00,000	-	36,00,000	22	26,40,000	62,40,000
d	Direct Labour	16	48,00,000	-	48,00,000	13	15,60,000	63,60,000
e	Manufacturing Overhead	2	6,00,000	-	6,00,000	5	6,00,000	12,00,000
f	Selling and Distribution Costs	4	12,00,000	-	12,00,000	2	2,40,000	14,40,000
	Total	34	1,02,00,000	-	1,02,00,000	136	1,63,20,000	2,65,20,000
3	Contribution (Step 1 - 2)	16	48,00,000	-	48,00,000	44	52,80,000	1,00,80,000
4	Annual Fixed Cost				40,00,000		20,00,000	60,00,000
5	Annual Profit (Step 3 - 4)				8,00,000		32,80,000	40,80,000

Analysis

APC Ltd

Overall profitability of APC Ltd. reduces from ₹75,20,000 per annum to ₹40,80,000 per annum. The reduction in profit is therefore ₹34,40,000 per annum. Reasons are:

(a) The cost of manufacturing Gex is only ₹30 per unit while Division Y is procuring this at ₹47 per unit from an external supplier. Annually this results in a loss of ₹40,80,000 (240,000 units of Gex×₹17 per unit).

(b) Since Division X no longer makes Gex for internal sales, it can ramp up its external sales to meet the full annual demand of 300,000 units. This results in extra external sales of 40,000 units annually. Each unit gives a contribution of ₹16 per unit. Therefore, additional contribution from sale of 40,000 units of Gex to external customers is ₹640,000 per annum.

(c) Therefore, netting both (a) and (b) above, the net loss to the company is **₹34,40,000** per annum.

Division Y

Impact on profit of Division Y, increase from ₹25,60,000 per annum to ₹32,80,000 per annum that is **₹7,20,000** per annum increase. This is due to the savings in procurement cost of Gex for Division Y. Instead of procuring Gex at ₹50 per unit Division Y proposes to buy it at ₹47 per unit externally. For its annual demand of 2,40,000 units of Gex**, it translates to savings of ₹7,20,000 annually in procurement cost for Division Y.**

Division X

Impact on profit of Division X, reduction from ₹49,60,000 per annum to ₹8,00,000 per annum. A substantial reduction of **₹41,60,000** in its divisional profit per year. Division X earns a contribution of ₹20 per unit of Gex from its internal transfer to Division Y. (Selling price ₹50 per unit less variable cost of manufacturing ₹30 per unit). If Division Y procures Gex externally, this would result in an annual loss of ₹48,00,000 in contribution for Division X (240,000 units ×₹20 per unit). However, due to additional external sales of 40,000 units of Gex, Division X can earn an additional contribution of ₹6,40,000 per year (40,000 units of Gex × ₹16 contribution per unit of external sale). Offsetting, this results in a lower contribution **of ₹41,60,000 per annum for Division X.**

This also results in excess capacity of 2,00,000 units per annum in Division X.

(iii)   APC Ltd. can suffer a loss of ₹34,40,000 per annum if Division Y decides to procure Gex from the external supplier. It costs on ₹30 per unit to manufacture Gex internally as compared to ₹47 per unit that Division Y is willing to pay to the external supplier. However, Division X is unwilling to reduce the price from ₹50 per unit since divisional performance is done based on the profit margin ratio of the division. Therefore, the management of the company has to step in to promote goal congruence. If Division Y buys GEX from the external supplier, not only is it costly for the company, it also results in a lot of unused capacity lying idle in Division X.

In the current scenario, one possible way of arriving at an acceptable transfer price range could be:

Division X is currently working at full capacity of 5,00,000 units per annum. Of this production, 2,40,000 units is supplied internally to Division Y while the balance is supplied to external market. The marginal cost of production of Gex is ₹30 per unit. If this were sold externally, it would earn a contribution of ₹16 per unit. **Therefore, the minimum transfer price the Division X would demand = marginal cost of production per unit + opportunity cost per unit = ₹30 + ₹16 = ₹46 per unit of Gex.**

(The other way of looking at this could also be that Division X does not incur any selling and distribution costs on internal transfers. To outside clients it needs to spend ₹4 per unit towards the same. Therefore, to make its price more competitive with the

external market, Division X can reduce the price by ₹4 per unit, which it has been recovering from Division Y for a cost it does not incur in internal transfers. Thus, based on its cost structure and the competitive profit margin it earns from external sales, it can price its internal transfers at ₹46 per unit.)

Division Y will be willing to pay the lower of net marginal revenue or the external buy-in price.

The Net Marginal Revenue per unit of Gextin = Selling price per Gextin – (marginal cost for Division Y other than the cost of Gex) = ₹180 - ₹42 = ₹138 per unit of Gextin. This translates that Division Y will be willing to pay upto ₹69 per unit of Gex, that it can incur without incurring a divisional loss. Meanwhile, the external buy-in price is ₹47 per unit.

Therefore, the maximum price Division Y will be willing to pay = lower of Net Marginal Revenue or external buy-in price = lower of ₹69 or ₹47 per unit of Gex. Therefore, Division Y will be willing to pay maximum ₹47 per unit of Gex to Division X.

Therefore, the transfer price range can be set between **₹46 - ₹47** per unit of Gex. Division X would then have to compete with the external supplier to retain its internal sales. This would promote more efficient working between Division X and Y. **By selling it at ₹46 per unit, the contribution of Division X would be maintained at ₹16 per unit. For Division Y. the procurement of Gex at ₹46 per unit would be beneficial since it is lower than the external market price. If transfer price set at external market rate ₹47 per unit, Division Y would still be able to improve its profit margin as compared to the original transfer price of ₹50 per unit.**

Given that the marginal cost of manufacturing Gex is only ₹30 per unit, the management has to ensure that production of Gex is made in-house. Performance measure at a divisional level should then not be restricted to financial performance alone (full profit responsibility) and should be accordingly modified to include non-financial / operational measures as well.

☞

Conceptually correct brief explanation is sufficient.

Question 5

(a) *APZ Company Ltd. manufactures spare parts and can be called "high volume based" manufacturing environment. The company is using the system of Total Productive Maintenance for maintaining and improving the integrity of manufacturing process. There are several different automated manufacturing machines located in the plant, through which manufacturing of spare parts are done and supplied to cater the demand in the market.*

A 12 hour shift is scheduled to produce a spare part in APZ Company Ltd. as shown in the schedule below. The shift has three 15 minute breaks and a 10 minute clean up period.

Production Schedule for Automated machine A 10:

Cycle: 10 (seconds),

Spare parts Manufactured: 3,360,

SCRAP: 75,

Unplanned Downtime: 36 minutes

Required

(i)   *CALCULATE OEE (Overall Equipment Effectiveness) and comment on it.* **(6 Marks)**

(ii) *The management of company has decided to ensure that things are done right the first time and that the defects and waste are eliminated from operations. Thus, they are planning to implement Total Quality Management (TQM) also.*

      SUMMARIZE the connection between Total Quality Management (TQM) and Total Productive Maintenance (TPM). **(4 Marks)**

(b) *SPS Limited uses activity based costing to allocate variable manufacturing overhead costs to products. The company identified three activities with the following information for last quarter :*

Activity	*Standard Rate*	*Standard Quantity per unit produced*	*Actual Costs*	*Actual Quantity*
Indirect Materials	₹ 20 per kilogram	0.5 kilogram per unit	₹9,40,000	48,000 kilogram
Product Testing	₹ 3 per test minute	10 minutes per unit	₹22,50,000	7,40,000 test minutes
Energy	₹ 0.20 per minute of machine time	4 minutes of machine time per unit	₹70,000	3,60,000 minutes of machine time

The company produced 80,000 units in the last quarter. Company policy is to investigate all variances above 5% of the flexible budget amount for each activity.

Required

(i)   *CALCULATE variable overhead expenditure variance and variable overhead efficiency variance for each of the activities using activity based costing. Clearly indicate each variance as favourable or unfavourable / adverse.* **(6 Marks)**

(ii) *INTERPRET the results of variable overhead efficiency variance as calculated in (i) above in respect of indirect materials and product testing activity.* **(2 Marks)**

(iii) *IDENTIFY the variances that should be investigated according to company policy. Show calculations to support your answer.* **(2 Marks)**

Answer

(a) (i)   Calculation of Loss of Time Per Shift

Mins.

Break	45
Clean up Period	10
Unplanned Downtime	36
Total Time Loss Per Shift	91

Availability Ratio *per shift* $=$ $\left\{\dfrac{720 \text{ mins.} - 91 \text{ mins.}}{720 \text{ mins.}}\right\} \times 100\%$

$=$ **87.36 %**

Actual Production $=$ 3,360 parts

Standard time $=$ 10 seconds

Standard Time Required $=$ 3,360 parts × 10 seconds/ 60

(Ideal Time) $=$ 560 minutes

Actual Time Taken $=$ 720 mins. – 91 mins.

$=$ 629 minutes

Performance Ratio $=$ $\left\{\dfrac{560 \text{ mins.}}{629 \text{ mins.}}\right\} \times 100\%$

$=$ **89.03%**

Quality Ratio $=$ $\left\{\dfrac{3,360 \text{ parts} - 75 \text{ parts}}{3,360 \text{ parts}}\right\} \times 100\%$

$=$ **97.77%**

Thus, **OEE** $=$ 0.8736 × 0.8903 × 0.9777

$=$ **76.04%**

Comment

Since OEE of APZ Company Ltd. is lesser than 85 % i.e. World Class Performance Level, Company is advised to improve its each ratio i.e. availability ratio, performance ratio and quality ratio by collecting information related to all downtime and losses on machines, analyzing such information through graphs and charts, making improvement decisions thereon like autonomous maintenance, preventive maintenance, reduction in set up time etc. and implementing the same.

Alternative

1. Scheduled Time = 12 hours = 720 Minutes (12 × 60)

2. Planned Down Time = 3 breaks × 15 minutes + clean- up 10 minutes = 55 minutes

3. Net Available Time (NAT) = 720 – 55 = 665 minutes

Automated Machine A

1. Unplanned Downtime = 36 minutes

2. Net Operating Time (NOT) = Net Available Time – Unplanned Downtime

3. NOT = 665 – 36 = 629 minutes

4. Ideal Operating Time (IOT): 3,360 Total Parts × 10 seconds = 33,600 / 60 = 560 minutes

5. Lost Operating Time (LOT): 75 Scrap Parts × 10 seconds = 750 / 60 = 12.50 minutes

Automated Machine A: OEE Factors are calculated as follows

1. Availability: NOT / NAT = (629 / 665) × 100 = **94.59 %**

2. Performance: IOT / NOT = (560 / 629) × 100 = **89.03%**

3. Quality: (IOT – LOT) / IOT = (560 – 12.50) / 560 × 100 = **97.77%**

4. OEE = A × P × Q = 94.59% × 89.03% × 97.77% = **82.34%**

Comment

Since the OEE of APZ Company Ltd is very close to 85% i.e. world class performance level, company should take measures to improve it and strive to attain 85% level. Availability Ratio of machine A10 is 94.59% exceeding the ideal value of > 90% which is good but the Performance and Quality Ratios need attention as they are below their ideal values of 95% and 99% respectively.

☞

> *OEE* can also be computed directly as under:
> 1) (Good Counts × Ideal Cycle Time)/ Planned Production Time *Or*
> 2) (Ideal Operating Time – Loss Operating Time)/ Net Available Time

(ii) The connection between TQM and TPM are summarized below:

- TQM and TPM make company more competitive by reducing costs, improving customer satisfactions and slashing lead times.

- Involvement of the workers into all phases of TQM and TPM is necessary.

- Both processes need fundamental training and education of participants.

- TPM and TQM take long time to notice sustained tangible benefits.

- Commitment from top managements is necessary for success of the implementation.

(b) **(i)** **Indirect Materials**

Efficiency Variance	=	Cost Impact of *undertaking activities* more/ less than *standard*
	=	(0.50kg. × 80,000units – 48,000 kg.) × ₹20
	=	₹1,60,000 (A)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	48,000kg. × ₹20 – ₹9,40,000
	=	₹20,000 (F)

Product Testing

Efficiency Variance	=	Cost Impact of *undertaking activities* more/ less than *standard*
	=	(10 mins. × 80,000 units – 7,40,000 mins.) × ₹3
	=	₹1,80,000 (F)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	7,40,000mins × ₹3 – ₹22,50,000
	=	₹30,000 (A)

Energy

Efficiency Variance	=	Cost Impact of *undertaking activities* more/ less than *standard*
	=	(4 mins. × 80,000 units – 3,60,000 mins.) × ₹0.20
	=	₹8,000 (A)
Expenditure Variance	=	Cost impact of paying more/ less than standard for actual activities undertaken
	=	3,60,000mins × ₹0.20 – ₹70,000
	=	₹2,000 (F)

(ii)   Indirect Materials

SPS actually spent 48,000 kg. or 8,000 kg. more than the standard allows. At a predetermined rate of ₹ 20 per kg., efficiency variance is 1,60,000 (A). Since actual quantity were higher than the standard, the variance is unfavorable. This adverse variance, could have been caused by the inferior quality, result of carelessness handling of materials by production workers or could as a result of change in methods of production, product specifications or the way in which quality of the product is checked or controlled.

Product Testing

Favorable efficiency variance amounting to ₹1,80,000 indicates that fewer testing minutes were expended during the quarter than the standard minutes required for the level of actual output. This may be due to employment of a higher skilled labor or improvement of skills of existing workforce through training and development leading to improved productivity etc.

(iii) Flexible Budget

Indirect Materials	= (0.50 kg. × 80,000 units) × ₹20 = ₹8,00,000	= ₹8,00,000× 5% **= ₹40,000**
Product Testing	= (10 mins. × 80,000 units) × ₹3 = ₹24,00,000	= ₹24,00,000 × 5% **= ₹1,20,000**
Energy	= (4 mins. × 80,000) × ₹0.20 = ₹64,000	= ₹64,000 × 5% **= ₹3,200**

Efficiency Variance for all the three activities are more than 5% of their flexible budget amount. So, according to the company policy, efficiency variances should be investigated.

Alternative

Statement Showing Identification of Variances to be investigated

	Calculation	Variance % of Flexible Budget	Criteria	Investigate Y or N
Indirect Materials				
Efficiency Variance	$\left(\dfrac{1,60,000}{8,00,000}\times100\right)$	**20%**	5%	**Y**
Expenditure Variance	$\left(\dfrac{20,000}{8,00,000}\times100\right)$	2.5%	5%	**N**
Product Testing				

Efficiency Variance	$\left(\dfrac{1,80,000}{24,00,000}\times100\right)$	**7.5%**	5%	**Y**
Expenditure Variance	$\left(\dfrac{30,000}{24,00,000}\times100\right)$	1.25%	5%	**N**
Energy				
Efficiency Variance	$\left(\dfrac{8,000}{64,000}\times100\right)$	**12.5%**	5%	**Y**
Expenditure Variance	$\left(\dfrac{2,000}{64,000}\times100\right)$	3.125%	5%	**N**

Question 6

(a) SEZ Limited produces three products S, Q and L which use   the same resources but in varying quantities. Product S uses one unit of component P which is purchased from outside suppliers at, ₹120 per unit. Details of the three products are as follows :

	S	Q	L
Annual Demand (units)	9,000	5,700	7,800
	Per unit ₹	Per unit ₹	Per unit ₹
Selling Price	310	275	224
Component P	120	-	-
Direct materials (₹8 per kg.)	24	32	24
Skilled labour (₹40 per hour)	20	60	40
Unskilled labour (₹24 per hour)	18	24	36
Variable Overhead (₹6 per machine hour)	18	24	24
Annual fixed costs are ₹15,00,000			

Maximum availability of skilled labour is 16,200 hours. Other resources are sufficient to meet the annual demand/sales.

Engineering division of the company came forward with a proposal to make the component 'P' in house with the following costs break up :

Direct materials (₹8 per kg.)	₹24
Skilled labour (₹40 per hour)	₹40
Unskilled labour (₹24 per hour)	₹ 8
Variable Overhead (₹6 per machine hour)	₹18
	₹90

For in-house making of the component 'P' there will not be any change in the annual fixed costs of the company. The company can either buy the component 'P' or make it in house.

Required

RECOMMEND the optimum production plan and profit for the year. Show calculation in support of your answer.   **(10 Marks)**

(b) *SW & Co is a firm of Chartered Accountants having head office at Delhi and four branches in different parts of Northern region. They are providing wide range of services to their esteemed clients. Their core services include Taxation, Corporate Audits, Bank Audits, Management Audits and Project financing. The firm is preparing its budgets for the financial year 2019-2020.*

The senior partners of the firm have stated that they would like to pay off the firm's loan taken from a public sector bank two years back for the renovation of their office premises this year and to have a positive cash reserve of ₹ 2,00,000 by the end of the year.

While comparing the actual cost with the budgeted data of last year, it was revealed that travelling costs were much higher than the budgeted costs. Fees receivable from some clients were so pending for more than three years thus distorting the expectations of cash budget.

DISCUSS the differences between feedforward control and feedback control using the above information about the cash budget of SW & Co.   **(10 Marks)**

Answer

(a)   Option-1

SEZ Ltd. produces 3 products Product S, Product Q and Product L. Each unit of Product S requires one unit of component P, which is currently procured from the external market at ₹120 per unit. There is a constraint in terms of skilled hours available for production, the maximum available is 16,200 hours. Given this constraint, the production plan should be based on the contribution derived per skilled labor hour spent on each product.

Calculation of skilled hour requirement for each of the products and component P

Skilled Hour Requirement

Sr. No.	Particulars	S	Component P	Q	L
1	Skilled Labour Cost *per unit*	20	40	60	40
2	Skilled Labour Rate *per hour*	40	40	40	40
3	Skilled Hours *per unit* (Step 1 / Step 2)	0.5	1	1.5	1

Note: When component P is manufactured, in-house Product S would require 1.5 hours of skilled labor hour per unit.

Contribution per unit and contribution per skilled hour (when component P is purchased)

Sr. No.	Particulars	S Per unit ₹	Q Per unit ₹	L Per unit ₹
1	Selling Price	310	275	224
	Variable Cost			
i	Component P (purchased)	120	0	0
ii	Direct Materials	24	32	24
iii	Skilled Labor	20	60	40
iv	Unskilled Labor	18	24	36
v	Variable Overhead	18	24	24
2	Total Variable Cost (Sum of steps i to v)	200	140	124
3	Contribution per unit (Step 1 - Step 2)	110	135	100
4	Skilled Hour per unit (refer skilled hour table - Step 3)	0.5	1.5	1
5	Contribution per skilled hour (Step 3 / Step 4)	220	90	100
	Ranking Based on Contribution per skilled hour	1	3	2

Based on this, SEZ Ltd. would first produce Product S, then Product L and then Product Q. The constraint of 16,200 hours of skilled labor has to be taken into account while drawing up the production plan. Production plan as per above ranking will be as below:

Product	Annual Demand (units)	Skilled Hour per unit (refer skilled hour table - Step 3)	Skilled hour utilized for production	Number of skilled hours remaining post production
	A	B	C = A × B	
S	9,000	0.5	4,500	11,700
L	7,800	1.0	7,800	3,900
Q	5,700	1.5	3,900	-

First, 9,000 units Product S is produced, this requires 4,500 hours of skilled labor. After production of Product S, 11,700 hours of skilled labor remain. (16,200 hours – 4,500 hours). Next 7,800 units of Product L can be produced, for which the skilled hours used are 7,800 hours. The remaining 3,900 hours would be used to produce Product Q.

Volume of Product Q that can be produced in 3,900 hours = **3,900 / 1.5 hours per unit = 2,600** units.

Therefore, profitability of SEZ Ltd. when component P is purchased:

Sr. No	Particulars	S	Q	L	Total ₹
1	Production (units)	9,000	2,600	7,800	
2	Contribution *per unit* (refer to contribution table - Step 3)	₹110.00	₹135.00	₹100.00	
3	Total Contribution (Step 1 × Step 2)	9,90,000	3,51,000	7,80,000	21,21,000
4	Fixed Cost				15,00,000
5	Total Profit (Step 3 - Step 4)				6,21,000

Option-2

Contribution when component P is manufactured in-house.

Note that Product S requires 0.5 hours and component P would require 1 hour of skilled labor per unit. If component P, a part of Product S is manufactured in-house, then Product S would in all require 1.5 hours of skilled labor per unit.

Based on this, contribution per unit and contribution per skilled hour if component P is manufactured is:

Sr. No.	Particulars	S Per unit ₹	Q Per unit ₹	L Per unit ₹
1	Selling Price	310	275	224
	Variable Cost			
i	Component P (made in house) refer note 1	90	0	0
ii	Direct Materials	24	32	24
iii	Skilled Labor	20	60	40
iv	Unskilled labor	18	24	36
v	Variable Overhead	18	24	24
2	Total Variable Cost (sum of steps i to v)	170	140	124
3	Contribution *per unit* (Step 1 - Step 2)	140	135	100
4	Skilled Hours *per unit* (refer skilled hour table - Step 3)	1.5	1.5	1
5	Contribution *per skilled hour* (Step 3 / Step 4)	93.33	90.00	100.00
6	Ranking Based on Contribution *per skilled hour*	2	3	1

Note 1

Component P has a variable cost, sum of direct material + skilled labor + unskilled labor + variable overhead, given to be ₹90 per unit

Each unit of Product S requires 1 more hour of skilled labor to manufacture component P. Skilled labor is a limited resource that costs ₹40 per hour. The savings SEZ Ltd. earns by manufacturing component P in-house is only ₹30 (external purchase cost is ₹120 per unit – cost of manufacturing component P in-house is ₹90 per unit). Therefore, it is profitable to purchase component P from the external market.

For further analysis, the impact of producing component P in-house would be:

Based on the revised ranking, SEZ Ltd. would first produce Product L, then Product S and then Product Q. The production plan is component P is made in-house would be

Product	Annual Demand (units)	Skilled Hour *per unit* (refer skilled hour table - Step 3)	Skilled hour utilized for production	Number of skilled hours remaining post production
	A	B	C = A × B	
L	7,800	1	7,800	8,400
S	9,000	1.5	8,400	0
Q	5,700	1.5	0	0

First, 7,800 units Product L is produced, this requires 7,800 hours of skilled labor. After production of Product L, 8,400 hours of skilled labor remain. (16,200 hours – 7,800 hours). The remaining 8,400 units would be used to produce Product S. Volume of Product S that can be produced in 8,400 hours = 8,400 / 1.5 hours per unit = 5,600 units. In this constraint, Product Q cannot be produced.

The profitability of SEZ Ltd. if component P is manufactured in-house:

Sr. No	Particulars	S	Q	L	Total ₹
1	Production (units)	**5,600**	-	**7,800**	
2	Contribution *per unit* (refer to contribution table - Step 3)	₹140.00	₹135.00	₹100.00	
3	Total Contribution (Step 1 × Step 2)	7,84,000	-	7,80,000	15,64,000
4	Fixed Cost				15,00,000
5	Total Profit (Step 3 - Step 4)				64,000

Recommendation

When component P is purchased, annual profits would be ₹6,21,000. When component P is manufactured in-house, annual profits would be ₹64,000, a reduction of ₹557,000 per year. Therefore, component P has to be bought externally. Optimum production plan would be

Product S – 9,000 units

Product Q – 2,600 units

Product L – 7,800 units

The decision to outsource make or buy decision might have strategic implications for the SEZ and should be formulated from strategic perspective with senior management's involvement.

(b) Feed forward control systems are the comparison of draft plans with the objectives of the company.

In the scenario provided the consultancy firm has a number of objectives, two of which are related to their cash flow. The first of these is to pay off the loan by the year end and the second is to have a positive cash reserve of ₹ 2,00,000 by the year end.

An initial draft of the cash budget will be produced based on the expected receipts and payments and other costs of the firm. Cash budgets to be prepared showing the cash inflows and outflows for each month so that the firm can identify its expected monthly cash balance. This can be compared with the company's objectives to see if their cash balance objectives are being achieved. It is this comparison that is the process of feed forward control.

It is also referred to as a preventive control. The rationale behind feed forward control is to foresee potential problems and take corrective action to ensure that the final output is as expected. Feed forward controls are desirable because they allow management to prevent problems rather than having to cure them later. Feed forward controls are costly to implement as it requires additional resources and investments.

Feedback control systems are the comparison of actual results against the budget that has been approved. Thus, in the context of the SW & Co., actual travelling costs comparison made against the budgeted costs and overdue fees receivables are also the process of feedback control.

As with any budget and actual comparison there may be an adverse or favorable variance. If this is significant then further analysis may be required to determine its cause. This comparison process is feedback control. It is also known as post action control. If any problem is identified after a process is complete, a corrective action is taken to rectify the problem. Feedback based system have the advantage of being simple and easy to implement.

Thus, initially the difference between feed forward control and feedback control systems is that feed forward occurs in the budget setting stage whereas feedback control occurs during the year. This means that feed forward identifies potential problems before they occur whereas feedback identifies problems after they have happened.