

SUGGESTED ANSWERS

SECTION - A

1.

- (i) (A)
- (ii) (B)
- (iii) (B)
- (iv) (C)
- (v) (D)
- (vi) (C)
- (vii) (A)
- (viii) (B)
- (ix) (A)
- (x) (A)
- (xi) (A)
- (xii) (B)
- (xiii) (B)
- (xiv) (A)
- (xv) (A)

SECTION – B

2. (a)

Various factors affecting facility location selection decision are summarized as under:

(i) Sourcing

- Availability of raw materials.
- Availability of natural resources, energy and waters.
- Availability of internet connectivity.
- Proximity to the key suppliers.
- Connectivity to alternate vendors.
- Opportunity to cross-docking and utilizing milk vans.

(ii) Markets

- Proximity to market.
- Coverage of wide geographical area (with close proximity to target customers) keeping the facility at focal point.
- Connectivity with a large customer base
- Lesser time to market
- Connectivity

(iii) Cost

- Lesser transportation cost and well availability of various transportation modes
- Lesser lease and / or rental cost.
- Tax, and other duties.
- Other hidden cost.

(iv) Socio-cultural, community and Political issues

- Supportive community
- Familiarity with language, rituals and culture
- Level of crime and other disturbances
- Availability of prospective employees
- Quality of living
- Statutory and regulatory rules and regulations
- Availability of medical facilities, fire and police

(v) Environmental Concerns

(vi) Availability of Skilled labour

(vii) Competitive pressure

2. (b)

Five stages of Design Thinking are aligned as under :

Stage 1 : Empathize - Research Your Users' Needs

Here, you should gain an empathetic understanding of the problem you're trying to solve, typically through user research. Empathy is crucial as it allows you to set aside your own assumptions about the world and gain real insight into users and their needs.

Stage 2 : Define - State Your Users Needs' and Problems

It's time to accumulate the information gathered during the Empathize stage. You then analyze your observations and synthesize them to define the core problems you and your team have identified. These definitions are called problem statements.

Stage 3 : Ideate - Challenge Assumptions and Create Ideas

Now, you're ready to generate ideas. The solid background of knowledge from the first two phases means you can start to "think outside the box", look for alternative ways to view the problem and identify innovative solutions to the problem statement you've created. Brainstorming is particularly useful here.

Stage 4 : Prototype - Start to Create Solutions

This is an experimental phase. The aim is to identify the best possible solution for each problem found. Your team should produce some inexpensive, scaled-down versions of the product. This could involve simply paper prototyping.

Stage 5 : Test - Try Your Solutions Out

Evaluators rigorously test the prototypes. Although this is the final phase, design thinking is iterative: Teams often use the results to redefine one or more further problems. So, you can return to previous stages to make further iterations, alterations and refinements - to find or rule out alternative solutions.

3. (a)

(i) & (ii) Analysis of average Annual Cost of replacement of the hammer :

(Amount in Rs.)

Year	1	2	3	4	5	6	7	8
Maintenance Cost	4000	6800	11000	15800	23000	28000	57000	69000
Cum. Maintenance Cost	4000	10800	21800	37600	60600	88600	145600	214600
Resale Value	35000	30000	25000	19000	15000	11000	9500	9000
Cost of Machine Resale value	315000	320000	325000	331000	335000	339000	340500	341000
Total Cost	319000	330800	346800	368600	395600	427600	486100	555600
Average Annual Cost	319000	165400	115600	92150	79120	71267	69443	69450

Since the average Cost of Replacement ₹69443 is lowest in the 7th year, the Machine (Pneumatic Hammer) should be replace every 7th year.

3. (b)

(i)

Advertising Expenditure (₹ in Lakh) (X)	Annual Sales (₹ in Crore) (Y)	χ^2	χY
1	5	1	5
3	6	9	18
4	8	16	32
5	9	25	45
7	10	49	70
$\sum \chi = 20$	$\sum y = 38$	$\sum \chi^2 = 100$	$\sum \chi y = 170$

Regression equation of Y on χ

$$Y = a + b\chi$$

To find the value of a and b, the following two equations are to be solved.

$$\sum y = na + b\sum \chi \quad \dots\dots\dots \text{Eqn. (i)}$$

$$\sum \chi y = a\sum \chi + b\sum \chi^2 \quad \dots\dots\dots \text{Eqn. (ii)}$$

By putting the value we get

$$38 = 5a + 20b \quad \dots\dots\dots \text{Eqn. (iii)}$$

$$170 = 20a + 100b \quad \dots\dots\dots \text{Eqn. (iv)}$$

Multiplying equation (iii) by 4 and putting it as no. (v) we get,

$$152 = 20a + 80b \quad \dots\dots\dots \text{Eqn. (v)}$$

By deducting equation (v) from equation (iv)

$$\text{We get, } 18 = 20b, \text{ Hence } b = \frac{18}{20} = 0.90$$

$$\text{By putting the value of b in equation (iii), we get } 38 = 5a + 18, \text{ Hence } a = \frac{20}{5} = 4$$

So, Regression equation of Y on χ is $Y = 4 + 0.90\chi$

- (ii) When advertising Expenditure (χ) = 8
Sales (Y) = $4 + 0.90 \times 8 = ₹11.20$ Crore
- (iii) When Sales (Y) = 7 Crore.
Advertising Expenditure (χ) = $\frac{(7 - 4)}{0.90} = ₹3.333$ Lakh
- (iv) When Sales (Y) = 13 Crore.
Advertising Expenditure (χ) = $\frac{(13 - 4)}{0.90} = ₹10$ Lakh

4. (a)

- (i) The given problem is a standard minimization problem. Subtracting the minimum element of each row from all its elements in turn, the given problem reduces to

Contractors	JOBS			
	A	B	C	D
1	40	20	0	10
2	10	20	40	0
3	10	40	20	0
4	10	10	0	10

- (ii) Now subtract the minimum element of each column from all its elements in turn. Draw the minimum number of lines horizontal or vertical so as to cover all zeros.

Contractors	JOBS			
	A	B	C	D
1	30	10	0	10
2	0	10	40	0
3	0	30	20	0
4	0	0	0	10

Since the minimum number of lines to cover all zeros is equal to 4 (= order of the matrix), this matrix will give optimal solution. The optimal assignment is made in the matrix below.

Contractors	JOBS			
	A	B	C	D
1	30	10	0	10
2	0	10	40	0
3	0	30	20	0
4	0	0	0	10

- (iii) The optimal assignment is

Contractors	JOBS	Cost (in thousand of Rupees)
1	C	70
2	A	70
3	D	90
4	B	80
	Total	310

Hence, total minimum cost of the project will be ₹310000 /-

4. (b)

Demand	Probability	Cumulative Probability	R. N. Interval
10	0.06	0.06	00 – 05
20	0.10	0.16	06 – 15
30	0.15	0.31	16 – 30
40	0.40	0.71	31 – 70
50	0.16	0.87	71 – 86
60	0.13	1.00	87 – 99

(i) & (ii) SIMULATION AND ASSESSMENT OF DEMAND AND PROFIT / (LOSS)

DAYS	Random Members	Purchase	Demand	Un-sold Stocks	Stock – out	Profit / (LOSS) (₹)
1.	93	40	60	---	20	2000 – 600 = 1400
2.	53	40	40	---	---	2000 – 0 = 2000
3.	81	40	50	---	10	2000 – 300 = 1700
4.	93	40	60	---	20	2000 – 600 = 1400
5.	88	40	60	---	20	2000 – 600 = 1400
6.	22	40	30	10	---	1500 – 1000 = 500
7.	32	40	40	---	---	2000 – 0 = 2000
8.	96	40	60	---	20	2000 – 600 = 1400
9.	79	40	50	---	10	2000 – 300 = 1700
10.	06	40	20	20	---	1000 – 2000 = (1000)
						12500

5. (a)

Let χ_1 , χ_2 and χ_3 denote the daily output of tables, Chairs and bookcases respectively.

Total Profit : $Z =$

$$30\chi_1 + 20\chi_2 + 12\chi_3$$

Timber (Cu. Ft) Constraints :

$$8\chi_1 + 4\chi_2 + 3\chi_3 \leq 640$$

Assembly department (Man-hours) Constraints :

$$4\chi_1 + 6\chi_2 + 2\chi_3 \leq 540$$

Finishing department (Man-hours) Constraints :

$$\chi_1 + \chi_2 + \chi_3 \leq 100$$

Minimum Production Requirements Constraints :

$$\chi_2 \geq 50$$

$$\chi_1 \geq 0, \chi_2 \geq 0, \chi_3 \geq 0 \text{ (none negative restrictions)}$$

Then, the appropriate mathematical formulation of the given problem as L. P. Model is
Objective function Maximize :

$$Z = 30x_1 + 20x_2 + 12x_3$$

Subject to Constraints :

$$8x_1 + 4x_2 + 3x_3 \leq 640$$

$$4x_1 + 6x_2 + 2x_3 \leq 540$$

$$x_1 + x_2 + x_3 \leq 100$$

$$x_2 \geq 50$$

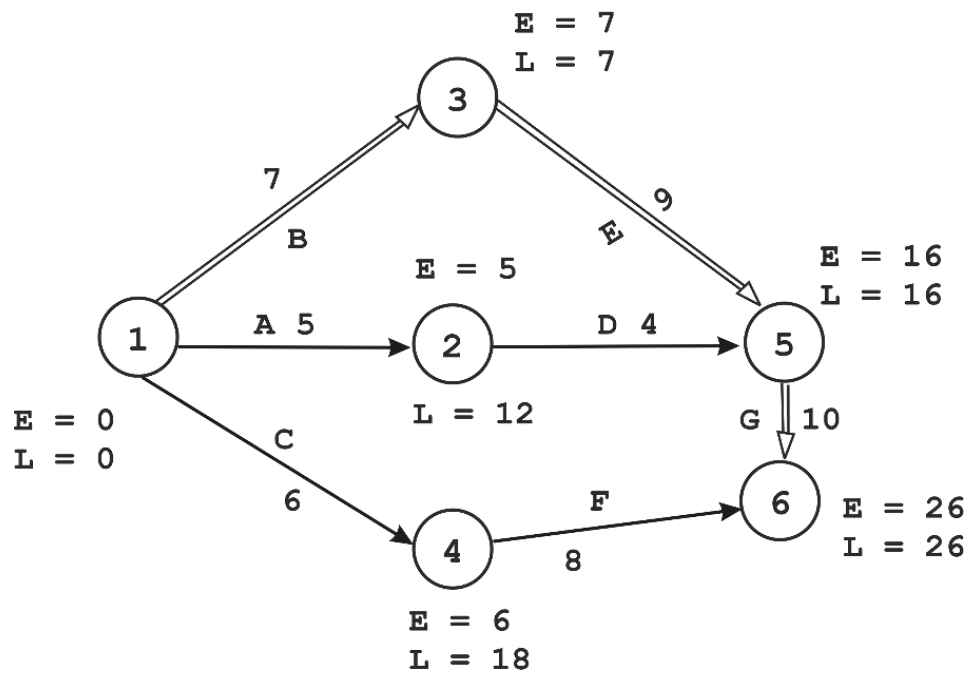
$$x_1 \geq 0, x_2 \geq 0 \text{ and } x_3 \geq 0$$

5. (b)

(i) Analysis of Expected Duration :

Activity and Identification		Duration in Days			
		Optimistic (a)	Most likely (m)	Pessimistic (b)	$T_e = \left(\frac{a + 4m + b}{6} \right)$
A	1 – 2	4	4	10	5
B	1 – 3	4	7	10	7
C	1 – 4	5	5	11	6
D	2 – 5	4	4	4	4
E	3 – 5	5	8	17	9
F	4 – 6	5	8	11	8
G	5 – 6	6	9	18	10

(ii)



(iii) Critical path is = B → E → G (1 – 3 – 5 – 6)
Duration = 26 Days.

(iv) **Analysis of Total Float**
(Expected time = T_e) (Duration in Days)

Activity and Identification		T_e	EST	EFT	LST	LFT	Total Float
A	1 – 2	5	0	5	7	12	7
B	1 – 3	7	0	7	0	7	0
C	1 – 4	6	0	6	12	18	12
D	2 – 5	4	5	9	12	16	7
E	3 – 5	9	7	16	7	16	0
F	4 – 6	8	6	14	18	26	12
G	5 – 6	10	16	26	16	26	0

6. (a)

The basic four element of Strategic Management are analyzed as under :

- (i) **Environmental scanning :** It refers to the monitoring, evaluating and disseminating of information from the external and internal environments to key people within the organisation. The purpose is to identify the strategic factors both internal and external elements that will shape the future of the organisation. The range of methods and techniques available for environmental scanning is wide. There are formal and systematic techniques as well as intuitive methods available. The techniques are single variable extrapolation, theoretical limit envelopes, dynamic modes, mapping, multivariate interaction analysis, unstructured expert opinion, structured expert opinion, structured inexpert opinion and unstructured inexpert speculation.
- (ii) **Strategy Formulation :** It refers to the development of long range plans for the effective management of environmental opportunities and threats, in the light of corporate strengths and weaknesses (SWOT). It includes defining the mission, setting objectives, developing strategies and setting policy guidelines.
- (iii) **Strategy Implementation :** It is the process by which strategies and policies are put into practice through the development of programs, budgets and procedures. This includes day to day decisions in resource allocation and is typically conducted by the middle and lower level managers with review by the top management. It involves taking actions at the functional, business and corporate levels to execute a strategic plan. Implementation includes, for example, putting quality improvement programs, changing the way product is designed, positioning the product differently, market segmentation, expanding through mergers and acquisitions and downsizing the company.
- (iv) **Evaluation and control :** It involves the process through which organisational activities and performances are monitored. The actual performances are compared to the desired performances and corrective actions are taken to resolve problems. The process of evaluation and control helps to identify the weakness and lacunae of the previously implemented strategic plan and thereby, stimulates the entire process to begin again.

6. (b)

There are three Levels of Artificial Intelligence (AI), namely :

- (i) Narrow AI
 - (ii) General AI / Human Level
 - (iii) Supper AI
- Narrow AI refers to the current state-of-the-art with existing software that automates a traditionally human activity and often outperforms humans in efficiency and endurance in one specialized area, e.g., forecasting the weather, autonomous driving, etc.
 - General AI / human-level AI describes the capacity of machines to understand their environment and reason and act accordingly, just as a human would in all activities across all dimensions, including scientific creativity, general knowledge, and social skills.
 - Super AI, the highest level of AI, is reached when AI becomes much smarter than the best human brains in practically every field.
 - Super AI systems can make deductions about unknown environments.
 - Machine learning (ML) describes automated learning of implicit properties of, or underlying rules for data. It is a major component for implementing
 - AI since its output is used as the basis for recommendations, decisions, and feedback mechanisms with regards to a previously unknown situation.
 - ML is an approach to creating AI. As most AI systems today are ML-based, the terms are often used interchangeably-particularly in a business context.
 - ML involves training algorithms on sample input data to optimize its performance on a specific task so that the machine gains a new capability.
 - Deep learning is a branch of AI. It mainly deals with neural networks that consist of many layers, hence the name “deep.” In the last years, deep neural networks have been the most successful AI approach in many areas.
 - AI is required for analyzing previously unavailable or indecipherable data (e.g., video or sound which previously could only be interpreted by humans), in order to detect quality issues.
 - AI also has the ability to help detection and analysis mechanisms, improve its own accuracy by continuously learning from the issues detected, and optimize manufacturing processes by incorporating feedback and adjusting the control parameters accordingly.
 - It is amazing to note how much friendly a technology AI is emerging to help people in quest for solving problems for society.
 - According to Basu (2019) versatility of AI is transcending all areas of solution building. The most encouraging is that AI is emerging as a friend of all for keeping cyber criminals away. It is also acquiring self-propelling energies.
 - More and more corporates, who were observing peers attaining competitive advantage using digital technologies, are now plunging into the act of digital transformation, particularly using AI with IoTs and Blockchain.

7. (a)

The activities incorporated in the PORTER'S value chain can be broadly divided into two parts, namely primary activities and Secondary or Support activities :

These activities are aligned as under :

Primary activities are directly concerned with the creation or delivery of a product or service. For example: for a manufacturing business the primary activists are as follows :

- Inbound logistics are activities concerned with receiving; storing and distributing inputs to the product or service including materials handling, stock control, transport, etc.
- Operations transform these inputs into the final product or service Operations include machining, packaging, assembly, testing, etc.
- Outbound logistics collect, store and distribute the product to customers, for example : warehousing, materials handling, distribution, etc.
- Marketing and sales provide the means whereby consumers / users are made aware of the product or service and are able to purchase it. This includes sales administration, advertising and selling.
- Service includes those activities that enhance or maintain the value of product or service, such as installation, repair, training and spares.

Support activities help to improve the effectiveness or efficiency of primary activities. The following are the support or secondary activities

- Procurement : It refers to the processes that occur in many parts of the organisation for acquiring the various resource inputs to the primary activities.
- Technology development : All value activities have a technology even if it is just know-how Technologies may be concerned directly with a pro duct or with processes or with a particular resource.
- Human Resource Management : This transcends all primary activities. It is concerned with those activities involved in recruiting, managing, training, developing and rewarding people within the organisation.
- Infrastructure : The formal systems of planning, finance, quality control, information management, and the structures and routines that are part of an organisation's culture.

7. (b)

The BCG Matrix has several advantages, however, there are at least three potential problem with the BCG Matrix.

These Potential Problems are appended as under :

(i) Definitional vagueness :

It can be hard to decide what high and low growth or share mean in particular situations. Managers are often keen to define themselves as 'high share' by defining their market in a particularly narrow way (for example, ignoring relevant international markets).

(ii) Capital market assumptions :

- The notion that a corporate parent needs a balanced portfolio to finance investment from Internal sources (cash cows) assumes that capital cannot be raised in external markets, for instance by issuing shares or raising loans.
- The notion of a balanced portfolio may be more relevant in countries where capital markets are underdeveloped or in private companies that wish to minimize dependence on external shareholders or banks.

(iii) Unkind to animals :

- Both cash cows and dogs receive ungenerous treatment, the first being simply milked, the second terminated or cast out of the corporate home. This treatment can cause motivation problems, as managers in these units see little point in working hard for the sake of other businesses.
- There is also the danger of the self-fulfilling prophecy. Cash cows will become dogs even more quickly than the model expects if they are simply milked and denied adequate investment.
- Finally, the notion that a dog can be simply sold or closed down also assumes that there are no ties so other business units in the portfolio, whose performance might depend in part on keeping the dog alive. This portfolio approach to dogs works better for conglomerate strategies, where divestments or closures are unlikely to have knock-on effects on other parts of the portfolio.

8. (a)

The softer issues (People and behavior are aligned as under :

People and behavior :

- (i) People are not like other resources. They influence strategy both through other competence and through their collective behaviour (culture). It may be emphasised that many of the problems of managing change result from a failure to understand, address and change culture.

This 'soft' side of HR management is concerned with the behaviour of people -both individually and collectively. The softer issues include the following.

- (ii) Understanding how they may need to change the paradigm of the organisation. This is particularly important when the business environment is changing quickly.
- (iii) Seeing their own role as people-oriented shapers of contest and not just as 'business analysts'. This will require an understanding of how these 'softer' aspects of strategy help or hinder strategic success.
- (iv) Understanding the relationship between behaviours and strategic choices. This is crucial if managers are properly to prioritise their efforts managing organisational behaviours for example, there may be some strategies where an organisation's current culture gives unique advantage over other organisations. Culture is a core competence.
- (v) Being realistic about the difficulty and time-scales in achieving behaviour changes Culture change is a long process of changing behaviours. The hard change tools (structures and systems) if used alone are unlikely to deliver.
- (vi) Being able to vary their style of managing change with different circumstances. So a manager's relationship and leadership skills with both internal and external stakeholders are important. Also, teams in organisations must be capable of operating different styles simultaneously.

8. (b)

Some of the areas that have the ability to create goal congruence are aligned as follows :

(i) Communication and Understanding :

Channels of communication and how goals are perceived are important to achieve goal congruence. Operational managers have a responsibility of being aware as to what actions are desirable and what goals are to be achieved. It should be understood that the communication of different goals can occur through informal channels, which involves meetings and face-to-face interactions, or through formal channels including budgets or other financial documents.

(ii) Create direction :

One of the reasons for lack of goal congruence is the absence of direction related to employees' behaviour. Performance management and goals facilitate efficient communication about what managers want their subordinates to focus on. There is a need to increase the employees understanding of the strategic objectives as well as the organisation's value drivers.

(iii) Motivation :

The problem of motivation can exist even though employees have knowledge about how to perform adequately because employees can act in their own self interest instead of in the organisation's best interest. The employees can make their own performance report better by allocating resources without befitting the organisation as a whole. The more motivated the employees of the organisation the better will be the goal congruence.

(iv) Incentives :

In order to increase the likelihood of employees working to achieve their individual goals, organisation's aim to influence motivation by providing incentives. Research suggests that individuals tend to perform better when they are rewarded. Rewards and compensations should create goal congruence between individual goals and organisational goals by stimulating individuals to perform by providing incentives, as rewards are related to increased effort.

(v) Connection :

It is very important to create a connection between goals, performance measures and incentives. In order to align the employees' self interest and overall organisational objectives it is necessary to relate incentives with performance. By linking incentives to certain goals, individuals tend to pay more attention to what is important.