PAPER- 09 - Operations Management & Information Systems

SECTION A - OPERATION MANAGEMENT

1. (a) If a firm sells 16,000 units, its loss is ₹ 40,000. But if it sells 20,000 units, its profit is ₹ 40,000. Calculate Fixed Cost.

Answer:

Change in quantity (20,000 – 16,000) units = 4,000 units
Change in profit =₹ [40,000 – (-40,000)] = ₹80,000.

$\therefore$ Unit contribution = $\frac{\text{Change in Profit}}{\text{Change in Output}} = \frac{₹80,000}{4,000} = ₹\ 20$

So, when output = 20,000 units
Total contribution= (₹ 20 x 20,000) = ₹ 4,00,000

We know Contribution = Fixed Cost + Profit
4,00,000 = Fixed Cost + 40,000
or, 4,00,000 – 40,000 = Fixed Cost
or, Fixed cost = 3,60,000.

(b) Monthly demand for a component 4,000 units. Setting –up cost per batch ₹ 120. Cost of manufacture per unit ₹ 20. Rate of interest 10% P.a. Calculate the EBQ.
Answer:

Calculation of EBQ:

EBQ = $\sqrt{\frac{2\times 12\times 4,000\times 120}{0.1\times 20}}$ = 2,400 units.

(c) What is Capacity Planning?

Answer:

Capacity Planning is the process of determining the production capacity needed by an organization to meet changing demands for its products. In this context, "capacity" is the maximum amount of work that an organization is capable of completing in a given period.

(d) The time study of a machinery operation recorded cycle time of 8.0, 7.0 ,8.0, 9.0 and 8.0 minutes. The analyst rated the observed worker as 90%. The firm uses a 0.15 allowance fraction. Compute the standard time.

Answer:

Average cycle time = $\frac{8.0+7.0+8.0+9.0+8.0}{5} = 8.0\,\text{minutes}$

Normal time = 8.0 × 0.9 = 7.2 minutes.

Standard Time = $\frac{7.2}{(1-0.15)} = 8.47\,\text{minutes}$

The standard time for this machinery operation would be set at 8.47 minutes, which is greater than the average cycle time observed. The average cycle time was adjusted for the rating factor (90%) and the allowance fraction (0.15).

(e) What is Quality Circle?

Answer:

Quality Circle: is a small group of 6 to 12 employees doing similar work and who voluntarily meet together on a regular basis to identify improvements in their respective work areas.

(f) The demand for three months for 100 watt bulbs is given below:

Period	January	February	March
Demand	1,000	1,200	1,600

If the weight assigned to the period of January, February and March are 0.25,0.35 and 0.4 respectively, forecast the demand for the month of April by using Weighted Moving Average Method.

Answer:

D1 = 1,000 Nos. W1 = 0.25
D2 = 1,200 Nos. W2 = 0.35
D3 = 1,600 Nos. W3 = 0.40

Therefore **Weighted Moving Average**

$= W_1 \times D_1 + W_2 \times D_2 + W_3 \times D_3 = 0.25 \times 1{,}000 + 0.35 \times 1{,}200 + 0.40 \times 1{,}600 = 250+420+640 = 1{,}310.$

The demand for the month of April is 1,310 Nos. of 100 watt bulbs.

(g) State the factors affecting Process Planning.

Answer:

Following are the factors affecting Process Planning:

- **(i)** Volume of production;
- **(ii)** Delivery dates for components of products;
- **(iii)** Accuracy and process capability of machines;
- **(iv)** Skill and expertise of manpower;
- **(v)** Material specifications;
- **(vi)** Accuracy requirements of components or parts.

(h) State the purpose of preparing Assembly Charts.

Answer:

Assembly Charts are prepared to provide an overall macro view of how materials and sub-assemblies are assembled to form finished products. These charts list all major materials, components, sub-assembly operations, inspections and assembly operations.

(i) List the limitations of using Bar Chart.

Answer:

Following are the limitations of using Bar Chart:

(i) Bar chart becomes too cumbersome while dealing with big and complex projects when considered in detail and efforts were to find out interaction/interdependence.
(ii) Bar chart does not indicate which tasks should be given priorities as regards the resources, i.e., men, money, materials, machinery, etc.
(iii) Changes in schedule cannot be evaluated.
(iv) It does not tell tolerance in activity times.
(v) It does not show continuing interrelationships of activities.
(vi) Bar chart it is not clear which are the activities dependant on each other and which are independent.

(j) A company intends to buy a machine having a capacity to produce 3,40,000 good parts per annum. The machine constitutes a part of the total product line. The system efficiency of the product line is 85%.The machine works for 2,000 hours/year. Find the system capacity.

Answer:

System Capacity = Actual output p.a./ System efficiency

$$= \frac{3,40,000}{0.85} = 4,00,000 \text{ units/annum}$$

$$= \frac{4,00,000}{2,000} = 200 \text{ units/hour}$$

(k) List the success factors associated with Quality Functions Deployment (QFD)?

Success Factors associated with Quality Function Development (QFD) are:
(i) Accurate Customer Voice.
(ii) Strong Management Commitment.
(iii) A good consultant.
(iv) Regular projects reviews.
(v) Milestone celebration to keep interest high and to develop a sense of closure.
(vi) Sharing with other teams to facilitate deeper learning.

(l) What is Linear Programming?

Answer:

Linear Programming is an optimization technique that allows the user to find a maximum profit/revenue or a minimum cost, based on the availability of limited resources and

certain constraints.

2. (a) Discuss the advantages of Preventive Maintenance.
(b) Discuss the pre-requisits of Just-In-Time (JIT) Manufacturing.

Answer:

(a) Advantages of Preventive Maintenance

(i) Increase in life of machines and equipments by reduction of wear and tear.
(ii) Reduction in frequency of breakdowns.
(iii) Improvement in productivity due to lesser machine down-time and consequent lossof production.
(iv) High reliability of production system due to lesser breakdown and repairs.
(v) Higher worker safety while using the plant and equipment.
(vi) Planned shutdowns and start-ups of plant and equipment possible.
(vii) Lesse requirement of stand-by machines due to lesser breakdowns.
(viii) Minimum work-in –progress inventory due to reduced production hold ups due to equipment breakdowns.
(ix) Lesser rejection and better quality control.
(x) Less serious consequences of breakdowns and lesser breakdown maintenance costs.

(b) Just-In-Time production drastically reduces WIP inventories throughout the production system and thereby reduces the manufacturing lead times. It results in a smooth, uninterrupted flow of small lots of products throughout production. Most successful JIT applications have been in repetitive manufacturing operations where batches of standard products are produced at high speeds and high volumes with materials moving in a continuous flow.

Before implementing the JIT system, certain changes to the factory and the way it is managed must occur.
These are:

(i) Stabilising the production schedules.
(ii) Making the factories more focused.
(iii) Increasing the production characteristics of manufacturing work centres.
(iv) Improving the product quality.
(v) Cross-training of the workers so that they are multi-skilled and competent in several jobs.
(vii) Reducing the equipment break downs through preventive maintenance.
(i) Developing long-term supplier relationships that avoid interruptions in material flows.

3. (a) Briefly explain concept testing.
(b) What do you mean by "Plant Shut Down"? Under what situations will you advise to resort to plant shut down?
(c) What is Retraining?

Answer:

(a) This is concerned with measuring customer reactions to the idea or concept of a product. In fact, it is a kind of research in which the product idea is screened before any money, time or labour are committed to making the prototype products. The idea of a product with as many details as possible is made known to the customers either verbally or through the use of suitable blueprints. The response of the customers is checked and only if it is found encouraging then the development of product prototype is taken up. For instance, when the rest of the world had largely gone in for *synthetic detergent in the powder* form, it was decided by the Hindustan Lever Limited to test a *detergent bar* as a concept, because in India most people do not use washing machines or even buckets and are accustomed to using a bar to rub on the fabric.

The concept testing can tell whether the product is likely to be a future success or not. To achieve better results, however, the product concept should include the finished product itself, with all details, *viz.*, packaging, price category, the brand name, etc. On the basis of these details interviews are conducted to collect the opinion of the would be purchasers.

The major advantage of concept testing is that the management could form early judgments on the likelihood of the market success of the new ideas. The other objectives of concept testing could be:

To evaluate the relative merits of several new product proposals,

To determine whether the product idea is to be abandoned or modified,

To determine the size of the potential market,

To guide the management to adopt suitable marketing policies in advance.

Concept testing has the following limitations or drawbacks:

It entails some risk of disclosing the company plans to competitors.

There is a time-lag for obtaining and assessing the results.

Respondents may overstate their interest and encourage unsound development.

The validity of any measure of potential market size obtained through early stage concept testing is often dubious.

Findings may be misleading if the test is not carried out properly.

(b) 'Plant shutdown' means total stoppage of plant and production activities by cutting off in-coming power supply to the plant. Plant shutdown is resorted to under the following conditions :

(i) At the time of puja holidays for doing preventive and major overhauling jobs.
(ii) Due to unusual situations.
(iii) At the time of recession when demands fall considerably.
(iv) When prices are less than total cost.
(v) For minor repair of generators, transformers, etc., after the normal working hours.

(c) Retraining can be defined as a programme designed to avoid redundancy and obsolescence. All the individuals become outdated with the passage of time, in terms of job requirements. The main aim to retrain is to protect rank and file workers at its core.

Retraining can also be referred to as a 'refresher course 'to install a new technologies, skills, methods etc whenever such things are necessary consequent upon modernization, upgradation, diversification etc. Infact, it is a process of infusing fresh blood in the organization.

4. (a) State Deming's 14 points for Quality Management.
(b) What are the benefits derived by an organization by adopting quality circles?

Answer:

(a) Deming's 14 points for quality Management

(i) Create constancy of purpose for continual improvement of product/services.
(ii) Adopt the new policy for economic stability.
(iii) Cease dependency on inspection to achieve quality.
(iv) End the practice of awarding business on price tag alone.
(v) Improve constantly and forever the system of production and service.
(vi) Institute training on the job.
(vii) Adopt and institute modern method of supervision and leadership.
(viii) Drive out fear. (Fear of failure, fear of change etc).
(ix) Breakdown barriers between departments and individuals.
(x) Eliminate the use of slogans, posters and exhortations.
(xi) Eliminate work standards and numerical quotas.
(xii) Remove barriers that rob the hourly worker of the right to pride in workmanship.
(xiii) Institute a vigorous program of education and retraining.
(xiv) Define top management's permanent commitment to ever improving quality and productivity.

(b) Benefits for an organization

(i) Improves Productivity
(ii) Improves quality of product
(iii) Reduces Wastage
(iv) Increases Employee Motivation
(v)Inspires more effective team work
(vi)Develops harmonious superior-subordinate relationship
(vii)Improves communication within organizations.
(viii)Develops a complete coherent problem solving environment

5. (a) Write short notes on Forecasting.
(b) What is 'Gantt Chart'? How is it used?

Answer:

(a) Forecasting - Forecasting means peeping into the future. As future is unknown and is anybody's guess but the business leaders in the past have evolved certain systematic and scientific methods to know the future by scientific analysis based on facts and possible consequences. Thus, this systematic method of probing the future is called forecasting. In this way forecasting of sales refers to an act of making prediction about future sales followed by a detailed analysis of facts related to future situations and forces which may affect the business as a whole.

Making of a proper forecast requires the assessment of both controllable and uncontrollable factors (both economic and non economic) inside and outside the organisation. The period of forecasting, that is the time range selected for forecasting depends on the purpose for which the forecast is made. The period may vary from one week to some years. Depending upon the period, the forecast can be termed as 'Short range forecasting', medium range forecasting' and 'Long range forecasting'. 'Short range forecasting period may be one week, two weeks or a couple of months. Medium range forecasting period may vary from 3 to 6 months.

Long range forecasting period may vary from one year to any period. The objective of above said forecast is naturally different. In general, short term forecasting will be of more useful in production planning. The manager who does short range forecast must see that they are very nearer to the accuracy. In long range forecast, the normal period used is generally 5 years. In some cases it may extends to 10 to 15 years also.

(b) The Gantt chart was probably the first technique to be applied to project planning and control. This chart is a simple way to show graphically both the anticipated and completed portions of a project. The horizontal axis of the chart represents time. Activities are scheduled by plotting them as bars on the chart, observing all precedence relationships. The percentage of each activity that is complete is indicated either by shading the appropriate portion of the bar or by placing a caret on the bar. By drawing a vertical line through the current data, one can determine whether the activities are ahead or behind schedule. The Gantt chart can be machine or project based. The machine based chart also includes a repair or maintenance activity, which is indicated by crossing out the time period in which the planned down time will occur.

Uses : There are various uses of such a technique :

(i) It forces a plan to be made.

(ii) Work planned and works accomplished are easily compared.

(iii) The chart is easy to produce and is dynamic in nature.

However, it fails to describe the dependency or interaction among various project tasks. Moreover, it is not readily adaptable as an analytical tool.

6. (a) State the benefits of Benchmarking.

(b) What factors might cause a company to order an amount larger or smaller than Economic Order Quantity?

Answer:

(a) Benefits of Benchmarking

- Benchmarking is particularly helpful in validating proposals for change.
- Benchmarking often results in creative imitation and the adoption of new practices that overcome previous industry barriers.
- This search for diversity and for innovative breakthroughs applied elsewhere is at the core of benchmarking benefits.
- By sharing information, all parties benefits, because it is difficult to excel in all activites.
- Sharing information and data is often the first hurdle to be overcome in the Benchmarking process.
- Do not, however, attempt benchmarking in areas in which trade secrets or sensitive information determines the outcome of the process.
- Benchmarking, used in conjunction with other quality techniques or used alone, can influence how an organisation operates.
- If the search for "Best", or just "Better" practices is performed correctly, then the likelihood of successful outcomes is quite high.
- Success however, assumes that pitfalls are avoided and prerequisites have been met before Benchmarking is initiated.

(b) It is always desirable to be strict to EOQ model. But it is to be kept in mind that EOQ model is useful under condition of certainty. Under real life situation, it is rarely so. Possible reasons for violation of EOQ model may be:

(i) The demand pattern of inventory and lead time is not certain.

(ii) Most of the firm maintains some amount of margin of safety or safety stock to cater to the contingent situation. These are based on own assumption. Hence actual quantity may vary from man to man.

(iii) The amount arrived at through EOQ computation may not be available or may not be accepted by the transporters.

(iv) Mismatch between transportation cost and EOQ associated cost.

(v) Panicky buying tendency of the person engaged.

(vi) Firm may be inclined to take advantage of impeding price hike by the suppliers and /or discount offered. Holding gain in inventory may also be important.

7. (a) What do you understand by' Forecasting of Human Resource Supply'?
(b) What are the objectives of Scheduling?
(c) State the principles of layout?

Answer:

(a) Forecasting of human resource supply is another important ingredient of HRP. After forecasting human resource needs, it is logical to determine how these needs can be met. For a new organisation, all personnel that are needed have to be procured from outside. However, in ongoing organisations, there are existing personnel who may be a source of supply to fill those needs. Considering both these sources, Armstrong has defined forecasting of human resource supply as follows:

"Manpower supply forecasting measures the number of people likely to be available from within and outside an organisation, after making allowances for absenteeism, internal movements and promotions, wastage and changes in work hours, and other conditions of work".

However, in this section, we shall focus our attention on internal source of supply of human resources and outside sources of supply will be taken later as there is a fundamental difference between the two sources. While existing personnel will remain available, with some exceptions, in the organisation during the human resource plan period, in order to get people from outside necessitates a separate process of recruitment and selection. In assessing the availability of human resources from internal sources, an organisation has to consider inflow and outflow of personnel during the plan period, and the type of personnel would be available. These can be undertaken by:

1. Human resource flow model
2. Human resource inventory.

(b) Objectives of Scheduling

(i) To prevent unbalanced use of time among departments and work centres or to evenly load all machines in the production line.

(ii) To utilise machines and labour in such a way that the output is produced within the established lead time so as to (a) deliver the products/services in time and (b) complete production in the shortest cycle time possible at minimum total cost of production.

(iii) To reduce idle time of labour and machines, which might be caused due to waiting for materials, waiting for movement, waiting for inspection and waiting for want of work.

(iv) To fix up delivery dates for various manufacturing activities and for the finished products.
(v) To increase the efficiency of production or productivity.

(c) The factors discussed above influence the choice of a particular type of layout. While accepting the selected layout, the layout engineer should be guided by certain principles. The layout selected in conformity with layout principles should be an ideal one. These principles are:

(i) **The Principle of Minimum Travel:** Men and materials should travel the shortest distance between operations so as to avoid waste of labour and time and minimize the cost of materials handling.
(ii) **Principle of Sequence:** Machinery and operations should be arranged in a sequential order. This principle is best achieved in product layout, and efforts should be made to have it adopted in the process layout.
(iii) **Principle of Usage:** Every foot of available space should be effectively utilized. This principle should receive top consideration in towns and cities where land is costly.
(iv) **Principle of Compactness:** There should be a harmonious fusion of all the relevant factors so that the final layout looks well integrated and compact.
(v) **Principle of Safety and Satisfaction:** The layout should contain built in revisions for safety for the workmen. It should also be planned on the basis of the comfort and convenience of the workmen so that they feel satisfied.
(vi) **Principle of Flexibility:** The layout should permit revisions with the least difficulty and at minimum cost.
(vii) **Principle of Minimum Investment:** The layout should result in savings in fixed capital investment, not by avoiding installation of the necessary facilities but by an intensive use of available facility.

8. (a) The breakdown probability of an equipment is given below :

Month	Probability
1	0.05
2	0.15
3	0.30
4	0.30
5	0.20

There are 50 equipments in the plant. The cost of individual preventive replacement is ₹ 15 per equipment and the cost of individual breakdown replacement is ₹ 30 per equipment. Find out the average break down maintenance cost per month.

(b) A workshop has 20 identical machines, whose failure pattern is as below :

Elapsed time in months :	**1**	**2**	**3**	**4**	**5**	**6**
No. of machines failed :	**4**	**3**	**3**	**3**	**3**	**4**

It costs ₹ 150 to attend to a breakdown machine. A maintenance contractor offers preventive maintenance of the machines and in return guarantees no failure of the machine for one year. He charges ₹ 450 per machine/ year.

Would you go for the preventive maintenance contract?

(c) What is Degeneracy in a simplex LPP? How is it resolved?

Answer:

(a) Average mean life of the equipment
= 1 x 0.05 + 2x 0.15 + 3 x 0.30 + 4 x 0.30 + 5 x 0.20 = 3.45 months.

Therefore, average breakdown maintenance cost per month = (50/3.45)x ₹ 30 = ₹ 434.78.

(b) Mean months in service before failure
= (4/20) x 1 + (3/20) x 2 + (3/20) x 3 + (3/20) x 4 + (3/20) x 5 + (4/20) x 6
= 3.5 months.

Yearly cost of breakdown maintenance
= No. of machines failed/year x Costs for attending each breakdown machine
= 20 x (12/3.5) x 150
= ₹ 10,286

Cost of preventive maintenance = ₹ 20 x 450 = ₹ 9,000 per year.

Since, ₹ 9,000 < ₹ 10,286, one should go for the preventive maintenance contract.

(c) The concept of obtaining a degenerate basic feasible solution in a LPP is known as Degeneracy. The degeneracy in a LPP may arise

(i) At the initial stage when at least one basic variable is zero in the initial basic feasible solution.

(ii) At any subsequent iteration when more than one basic variable is eligible to leave the basic and hence one or more variables becoming zero in the next iteration and the problem is said to degenerate. There is no assurance that the value of the objective function will improve, since the new solutions may remain degenerate. As a result, it is possible to repeat the same sequence of simplex iterations endlessly without improving the solutions. This concept is known as cycling or circling.

Degeneracy is solved by the following procedure:

(i) Divide each element in the tied rows by the positive coefficients of the key column in that row.

(ii) Compare the resulting ratios, column by column, first in the identity and then in the body, from left to right.

(iii) The row which first contains the smallest algebraic ratio contains the leaving variable.

9. (a) A firm received an order to make and supply eight units of standard product which involves intricate labour operations. The first unit was made in 10 hours. It is understood that this type of operations is subject to 80% learning rate. The workers are getting a wage rate of ₹12 per hour.

(i) What is the total time and labour cost required to execute the above order?

(ii) If a repeat order of 24 units is also received from the same customer, what is the labour cost necessary for the second order?

(b) X Ltd. must choose whether to go ahead with either of two mutually exclusive projects A and B. The expected profits are as follows:

	Profit if there is Strong Demand	Profit/(loss) if there is Weak Demand
Project A (₹)	**4,000**	**(1,000)**
Project B(₹)	**1,500**	**500**
Probability of demand	**0.3**	**0.7**

(i) What should be the decision based on expected values, if no information about demand were available?
(ii) What is the value of Perfect Information about the demand?

Answer:

(a) 80% learning curve results are given below-

Production (Units)	Cumulative Avg. Time(Hours)	Total Time (hours)
1	10	10
2	8	16
4	6.4	25.6
8	5.12	40.96
16	4.096	65.54
32	3.2768	104.86

Labour time required for the first eight units = 40.96 hours
Labour cost required for 8 units = 40.96 hours × ₹12/hr = ₹491.52
Labour time for 32 units = 104.86 hours
Labour time for first eight units = 40.96 hours
Labour time required for 2nd order of 24 units =36.90 hours
Labour cost for 24 units =63.90 hours × ₹12/hr = ₹766.80

(b) (i) When no information for demand is available, the project with higher EV of profit would be selected.

	Project A		Project B	
Probability	Profit	EV	Profit	EV
0.3	4,000	1,200	1,500	450
0.7	(1,000)	(700)	500	350
1.0		500		800

The EV of B is greater than EV of A, therefore project B would be selected.
Project B better option, if the demand turns out to be weak, but if the demand turns out to be strong then option A is a better option with 30% probability.

(ii) If perfect information for demand is available then it would indicate whether the demand will be weak or strong. Demand if forecasted to be weak then project B should be selected. However, if demand is projected as strong then project A shall be selected.

Perfect information would improve the profit from ₹ 1,500 which would have been earned, by selection B to ₹4000 from A.

Forecast Demand	Probability	Project Chosen	Profit	EV of Profit
Weak	0.7	B	500	350
Strong	0.3	A	4,000	1,200
EV of profit with perfect information				1,550

	(₹)
EV of profit without perfect information	800

(i.e. choose B all the time)	
EV of profit with perfect information	1550
Value of perfect information	750

The information provided should not cost more than 750 to collect, and then only it would be worth it.

10. (a) Contribution per unit (₹)

	WH 1	WH 2	WH 3	WH 4	Total supplies
Plant I	**48**	**60**	**56**	**58**	**14**
Plant 2	**40**	**55**	**53**	**60**	**26**
Plant 3	**50**	**100**	**60**	**62**	**36**
Total Demand	**20**	**32**	**25**	**21**	

Find the initial solution by North-West Corner method. Is the initial solution feasible?

(b) Four products A,B,C and D have ₹5, ₹7, ₹3 and ₹9 profitability respectively.
First type of material (limited supply of 800 kgs.) is required by A,B, C and D at 4 kgs, 3 kgs, 8 kgs and 2 kgs respectively per unit.
Second type of material has a limited supply of 300 kgs, and is for A,B,C, and D at 1 kg, 2 kgs, 0 kg and 1 kg per unit. Supply of other type of materials consumed is not limited. Machine hrs. available are 500 hours and the requirements are 8,5,0,4 hours for A,B,C and D each per unit. Labour hours are limited to 900 hours and requirements are 3,2,1 and 5 hours for A,B,C and D respectively.
How should the firm approach so as to maximize its profitability? Formulate this as a linear programming problem. You are not required to solve the LPP.

Answer:

(a) Total demand is 98. Total supply is 76. We introduce dummy plant with supply as 22 and contribution per unit to be zero

Contribution per unit (₹)

	WH 1	WH 2	WH 3	WH 4	Total supplies
Plant 1	48	60	56	58	14
Plant 2	40	55	53	60	26
Plant 3	50	100	60	62	36
Dummy Plant	0	0	0	0	22
Total Demand	20	32	25	21	98

Opportunity Loss Matrix

	WH 1	WH 2	WH 3	WH 4	Total supplies
Plant 1	14				14

Plant 2	(6)	(20)			26
Plant 3		(12)	(24)		36
Dummy Plant			(1)	(21)	22
Total Demand	20	32	25	21	98

Initial Solution

From	**Plant 1**	**Plant 2**	**Plant 2**	**Plant 3**	**Plant 3**	**Plant 4**	**Plant 4**
To	WH 1	WH 1	WH2	WH2	WH3	WH3	WH4
Units	14	6	20	12	24	Dummy	Dummy
Feasibility test	m + n -1 =7		No. of allocations = 7		The solution is **feasible**		

(b)

Particulars	**A**	**B**	**C**	**D**	**Total Available**
Profit per unit	5	7	3	9	
Material 1 (kg. per unit)	4	3	8	2	800
Material 2 (kg. per unit)	1	2	0	1	300
Machine Hours (per unit)	8	5	0	4	500
Labour Hours (per unit)	3	2	1	5	900

The Objective of the firm is to maximize the profitability which is subject to the limited availability of resources.
Let X_1, X_2 X_3 & X_4 be the units produced of A,B,C & D respectively.

Objective Function-
$Z_{MAX} = 5X_1+7X_2+3X_3+9X_4$
Subject to –
Material 1: $4X_1+3X_2+8X_3+2X_4 \leq 800$
Material 2: $1X_1+2X_2+0X_3+1X_4 \leq 300$
Machine Hour: $8X_1+5X_2+0X_3+4X_4 \leq 500$
Labour Hours: $3X_1+2X_2+1X_3+5X_4 \leq 900$

11. XYZ Co. Ltd. evaluates the investment proposals on the basis of three factors: demand, profit per unit and required amount of investment. The data for a proposal under the consideration of its Board are given below:

Annual demand (Kgs)	**20,000**	**30,000**	**40,000**	**45,000**	**50,000**	**55,000**	**70,000**
Probability	**0.10**	**0.20**	**0.14**	**0.16**	**0.10**	**0.25**	**0.05**

Profit per Kg.(₹)	10	20	30	40	50	60	70
Probability	0.25	0.15	0.10	0.20	0.15	0.10	0.05

Investment (₹)	20,00,000	30,00,000	50,00,000
Probability	0.30	0.40	0.30

Using simulation process, repeat the trial 10 times, compute the ROI for each trial and the average ROI. Use the following random numbers:

Demand	67, 63, 39, 55, 29, 78, 70, 06, 78, 76
Profit per unit	28, 57, 60, 17, 64, 20, 27, 58, 61, 30
Investment	76, 78, 06, 70, 78, 29, 55, 39, 63, 67

Answer:

Probability distribution (Demand)

Demand	Probability	Cum. Prob.	Range	Range for simulation
20,000	0.10	0.10	0 – 0.10	0- 0.09
30,000	0.20	0.30	0.10 – 0.30	0.10 – 0.29
40,000	0.14	0.44	0.30 – 0.44	0.30 – 0.43
45,000	0.16	0.60	0.44 – 0.60	0.44 – 0.59
50,000	0.10	0.70	0.60 – 0.70	0.60 – 0.69
55,000	0.25	0.95	0.70 – 0.95	0.70 – 0.94
70,000	0.05	1.00	0.95 – 1.00	0.95 – 0.99

Probability distribution (Profit/ Kg)

Profit/ Kg.	Probability	Cum. Prob.	Range	Range for simulation
10	0.25	0.25	0- 0.25	0 – 0.24
20	0.15	0.40	0.25 – 0.40	0.25 – 0.39
30	0.10	0.50	0.40 – 0.50	0.40 – 0.49
40	0.20	0.70	0.50 – 0.70	0.50 – 0.69
50	0.15	0.85	0.70 – 0.85	0.70 – 0.84
60	0.10	0.95	0.85 – 0.95	0.85 – 0.94
70	0.05	1.00	0.95 – 1.00	0.95 – 0.99

Probability distribution (Investment)

Investment	Probability	Cum. Prob.	Range	Range for simulation
20 L	0.30	0.30	0 – 0.30	0 – 0.29
30L	0.40	0.70	0.30 – 0.70	0.30 – 0.69
50 L	0.30	1.00	0.70 – 1.00	0.70 – 0.99

Statement showing ROCE under various trials

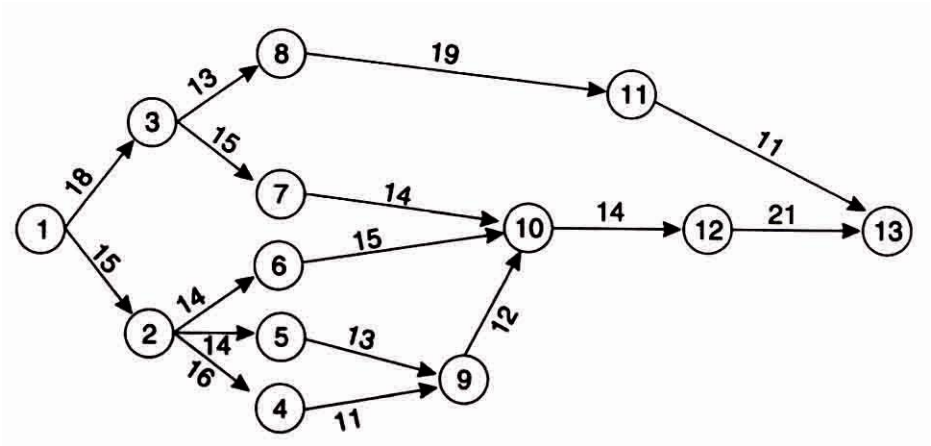
Trial	Demand	Profit per Kg.	Investment	ROCE
1	50,000	20	50L	20.00%
2	50,000	40	50L	40.00%
3	40,000	40	20L	80.00%
4	45,000	10	50L	9.00%
5	30,000	40	50L	24.00%

6	55,000	10	20L	27.50%
7	55,000	20	30L	36.67%
8	20,000	40	30L	26.67%
9	55,000	40	30L	73.33%
10	55,000	20	30L	36.67%
Average return on CE				37.38%

12. Draw the network for the following activities and find critical path and total duration of project :

Activity	Duration (months)	Activity	Duration (months)
1-2	**15**	**5-9**	**13**
1-3	**18**	**6-10**	**15**
2-4	**16**	**7-10**	**14**
2-5	**14**	**8-11**	**19**
2-6	**14**	**9-10**	**12**
3-7	**15**	**10-12**	**14**
3-8	**13**	**11-13**	**11**
4-9	**11**	**12-13**	**21**

Answer :



Paths	Name of path	Duration (months)
1-3-8-11-13	A	18+13+19+11 =61
1-3-7-10-12-13	B	18+15+14+14+21=82
1-2-6-10-12-13	C	15+14+15+14+21 =79
1-2-5-9-10-12-13	D	15 +14+13+12+14+21 = 89 **Critical path**
1-2-4-9-10-12-13	E	15+16+11+12+14+21 = 89 **Critical path**
There are two critical paths.		

13. (a) Two alternative methods X and Y using different tooling set-ups may be employed to manufacture a component on a particular machine tool whose operating cost is ₹ 20 (including wages of operator) per hour.

Particulars	Method X	Method Y
Component	4000 pieces	3000 pieces
Cost of tooling	₹ 320	₹1500
Production rate per hour	10 pieces	15 pieces

Justify with suitable calculation which of the two methods would you choose as being more economical for regular production? Would your answer be different if only 1000 pieces of particular component are required?

(b) A firm is considering for alternative locations for a new plant. It has attempted to study all costs at the various locations and finds the production costs of the following items vary from one location to another. The firm will finance the new plant from deposits, fetching 10% interest.

Particulars	A	B	C	D
Labour (per unit) (₹)	7.50	11.00	8.00	9.00
Plant construction cost (₹ Crores)	4.6	3.9	4.0	4.8
Material & equipment (per unit) (₹)	4.30	6.00	4.00	5.50
Electricity (per yr.) (₹ Lakhs)	3.0	2.60	3.00	2.80
Water (per yr.) (₹ Lakhs)	0.7	0.6	0.7	0.7
Taxes (per year) (₹ Lakhs)	3.3	2.8	6.3	3.5
Transportation (Per unit) (₹)	0.20	1.00	1.00	0.50

The material and equipment includes a projected depreciation, but no interest. If the plant is designed to have an effective system capacity of 10,000 units per year and is expected to operate at 80% efficiency, what is the most economic location on the basis of actual output?

Answer:

(a) The unit cost of two methods are as follows:

	Method X	Method Y
Cost of tooling	₹ 320	₹1500
Hours required	4000/10 = 400	3000/15 = 200
Operating cost	400*20 = ₹8000	200*20 = ₹4000
Total production costs	Rs8320	5500
No. of pieces	4000	3000
Cost per piece	₹2.08	₹1.83

Therefore Method Y is more economical.

If only 1000 pieces are required the cost would be as follows:

	Method X	Method Y
Cost of tooling	₹320	₹1500
Hours required	1000/10 = 100	1000/15 = 66.67
Operating cost	100*20 = 2000	66.67*20 = 1333.4
Total cost of production	2320	2833.40
Cost per unit	₹2.32	2.83

In this case X is cheaper.

(b) Actual output = (System efficiency x System capacity)

= 0.80 x 10,000 = 8,000 units / year.

Particulars	A	B	C	D
Fixed cost/year (₹ In lakhs)				
10% of investment	46.00	39.00	40.00	48.00
Electricity	3.00	2.60	3.00	2.80
Water	0.70	0.60	0.70	0.70
Taxes	3.30	2.80	6.30	3.50
Total	53.00	45.00	50.00	55.00
Variable cost/unit (₹)				
Material and equipment	4.30	6.00	4.00	5.50
Labour	7.50	11.00	8.00	9.00
Transportation	0.20	1.00	1.00	0.50
Total	12.00	18.00	13.00	15.00

Cost per site = Fixed cost + Variable Cost

A = 53,00,000 + 8,000 x 12 = ₹ 53,96,000

B = 45,00,000 + 8,000 x 18 = ₹ 46,44,000

C = 50,00,000 + 8,000 x 13 = ₹ 51,04,000

D = 55,00,000 + 8,000 x 15 = ₹ 56,20,000

The most economic location is B.

14. After observing heavy congestion of customers over a period of time in a petrol station, Mr. Ustad has decided to set up a petrol pump facility on his own in his nearby site. He has complied statistics relating to the potential customer arrival pattern and service pattern as given below. He has also decided to evaluate the operations by using the simulation technique.

Arrivals		Services	
Inter-arrival time (minutes)	**Probability**	**Inter-arrival time (minutes)**	**Probability**
2	**0.22**	**4**	**0.28**
4	**0.30**	**6**	**0.40**
6	**0.24**	**8**	**0.22**
8	**0.14**	**10**	**0.10**
10	**0.10**		

Assume:

(i) The clock starts at 8.00 hours

(ii) Only one pump is set-up

(iii) The following 12 Random Nos. are to be used to depict the customer arrival pattern

78	**26**	**94**	**08**	**46**	**63**	**18**	**35**	**59**	**12**	**97**	**82**

(iv) The following 12 Random Nos. are to be used to depict the service pattern

44	**21**	**73**	**96**	**63**	**35**	**57**	**31**	**84**	**24**	**05**	**37**

You are required to find out the

(i) Probability of the pump being idle

(ii) Average time spent by a customer waiting in queue.

Answer:

Inter-arrival time				Service time			
Inter-arrival	**Probability**	**Cumulative probability**	**Range**	**Inter-arrival time**	**Probability**	**Cumulative probability**	**Range**

time (minutes)				(minutes)			
2	0.22	0.22	00-21	4	0.28	0.28	00-27
4	0.30	0.52	22-51	6	0.40	0.68	28-67
6	0.24	0.76	52-75	8	0.22	0.90	68-89
8	0.14	0.90	76-89	10	0.10	1.00	90-99
10	0.10	1.00	90-99				

Sl.no	Random No. for inter-arrival	Inter-arrival time	Entry time in queue	Service start time	Random no. for service	Service time	Service end time	Waiting time of customer	Idle time
1	78	8	8.08	8.08	44	6	8.14	-	8
2	26	4	8.12	8.14	21	4	8.18	2	-
3	94	10	8.22	8.22	73	8	8.30	-	4
4	08	2	8.24	8.30	96	10	8.40	6	
5	46	4	8.28	8.40	63	6	8.46	12	
6	63	6	8.34	8.46	35	6	8.52	12	
7	18	2	8.36	8.52	57	6	8.58	16	
8	35	4	8.40	8.58	31	6	9.04	18	
9	59	6	8.46	9.04	84	8	9.12	18	
10	12	2	8.48	9.12	24	4	9.16	24	
11	97	10	8.58	9.16	05	4	9.20	18	
12	82	8	9.06	9.20	37	6	9.26	14	
Total Validity Time								140	12

Average waiting time spent by the customer= 140/12= 11.67 minutes.
Probability of idle time of the petrol station= 12/86= 0.1395 or 13.95% idle, say 14%.

15.(a) A plant manager is considering replacement policy for a new machine. He estimates the following costs. (All costs in ₹ 000)

Year	1	2	3	4	5	6
Replacement cost at beginning of year	**100**	**110**	**125**	**140**	**160**	**190**
Salvage value at end of year	**60**	**50**	**40**	**25**	**10**	**0**
Operating costs	**25**	**30**	**40**	**50**	**65**	**80**

Find an optimal replacement policy and corresponding minimum cost.

(b)By employing network techniques like PERT and CPM one can plan,schedule and control a given project very effectively. – Discuss.

Answer:
(a)

Year(n)	Operating Cost M(t)	Cumulative operating cost ∑M(t)	Replacement cost at beginning of year (C)	Salvage value at end of year S(t)	Depreciation C-S(t)	Total Cost TC_n	Average Cost ATC_n

(1)	(2)	(3)	(4)	(5)	(6)=(4-5)	(7)=(3 +6)	(8)=(7/1)
1	25	25	100	60	40	65	65
2	30	55	110	50	60	115	57.5
3	40	95	125	40	85	180	60
4	50	145	140	25	115	260	65
5	65	210	160	10	150	360	72
6	80	290	190	0	190	480	76.7

Since the average total cost per year is minimum in the second year, the machine should be replaced after 2 years and the corresponding minimum annual cost of replacement is ₹57500.

(b) Planning and control are two of the most important functions of management. Planning involves the formulation of objectives and goals that are subsequently translated into specific plans and projects. The function of control is to institute a mechanism that can trigger a warning signal of actual performance in deviating from the plan. The PERT and CPM models are extremely useful for the purpose of planning, analyzing, scheduling and controlling the progress because:

(i) Each activity involved in the project is mapped on the network in a logical sequence with timings of each activity marked.
(ii) Critical activities are identified which have no slack.
(iii) The non-critical activities are identified and free as well as total float is calculated.
(iv) EST, EFT, LST and LFT are marked on the diagram.
(v) Critical path is identified and in case of hindrance additional resources can be employed to keep to the time schedule.
(vi) Crashing of the activities is made feasible to conform to the changing considerations.
(vii) Resource leveling is also feasible.
(viii) PERT/CPM give us a lot of flexibility as regards resource, time and cost.

16. A pharmaceutical Company has 100 kg. of A, 180 kg. of B and 120 kg of C available per month. They can use these materials to make three basic pharmaceutical products namely 5-10-5,5-5-10 and 20-5-10, where the numbers in each case represent the percentage by weight of A, B and C respectively in each of products. The cost of these raw materials are given below:

Ingredient	Cost per Kg (₹)
A	**80**
B	**20**
C	**50**
Inter Ingredients	**20**

Selling prices of these products are ₹50.5, ₹53.00 and ₹55.00 per kg. respectively. There is a capacity restriction of the company for the product 5-10-5; so as they cannot produce more than 30 kg per month. Determine how much of each of the products they should produce in order to maximize their monthly profit.

Answer:

Let the products to be manufactured be denoted by X_1, X_2 and X_3.

	Ingredients			
Products	**A**	**B**	**C**	**Inter**

X_1	5%	10%	5%	80%
X_2	5%	5%	10%	80%
X_3	20%	5%	10%	65%
Cost per kg	₹80	₹20	₹50	₹20

Cost of X_1 = 5% × ₹80+ 10% × ₹20 + 5% × ₹50 + 80% × ₹20
= ₹[4+2+2.50+16] = ₹24.50/ kg
Cost of X_2 = 5% × ₹80+ 5% × ₹20 + 10% × ₹50 + 80% × ₹20
= ₹[4+1+5+16] = ₹26.00/ kg
Cost of X_3 = 20% × ₹80+ 5% × ₹20 + 10% × ₹50 + 65% × ₹20
= ₹[16+1+5+13] = ₹35.00/ kg

Margin of Product X_1 = ₹50.50 - ₹24.50 = ₹26
Margin of Product X_2 = ₹53.00 - ₹26.00 = ₹27
Margin of Product X_3 = ₹55.00 - ₹35.00 = ₹20

Now, the problem can be formulated in mathematical form as follows:
Maximize $Z = 26x_1 + 27x_2 + 20x_3$

Subject to the constraints

$$\frac{1}{20}x_1 + \frac{1}{20}x_2 + \frac{1}{5}x_3 \le 100$$

or $x_1 + x_2 + 4x_3 \le 2000$ ..... (1)

$$\frac{1}{10}x_1 + \frac{1}{20}x_2 + \frac{1}{20}x_3 \le 180$$

or $2x_1 + x_2 + x_3 \le 3600$ ..... (2)

$$\frac{1}{20}x_1 + \frac{1}{10}x_2 + \frac{1}{10}x_3 \le 120$$

or $x_1 + 2x_2 + 2x_3 \le 2400$ ..... (3)

$x_1 \le 30$ ..... (4)

$x_1, x_2, x_3 \ge 0$ ..... (5)

Where x_1, x_2 and x_3 denote the quantity in kg. of three products to be manufactured.

17. (a) What is Material Control Cycle? Discuss the steps involved in it.
(b) List the steps involved in using Network Scheduling Techniques.

Answer:

(a) Material Control Cycle comprises all of those procedures which are necessary for the provision of materials for the manufacturing process with a minimum investment and at lowest cost possible. Knowledge of this cycle is fundamental to an understanding of the principles and practice of material control.

The steps involved in material control cycle are as follows:

(i) Determining material needs.
(ii) Preparing requisitions for purchased items and requests for work orders for parts made in the shops.
(iii) Receiving purchased materials and finished parts into the plant.
(iv) Inspecting purchased material and parts and inspection of finished shop made parts. Delivering all the parts and materials to the stores for storage.
(v) Entering receipts in stores records, apportioning material in the records to current orders, authorizing requisitions of materials from stores for production of shop parts and requisitions of parts from stores for assembly into finished products.
(vi) Issuing of parts and materials to the shop for production and assembly.
(vii) Recording the issue in store records.
(viii) Entry of receiving and issuing transactions to cost and accounting records.
(ix) Determination of necessity for replacement of stores which leads to step number one and the cycle repeats.

Other activities of materials control section are:

(i) Determining the proper quantity to requisition for each item of material for each purchased and manufactured part.
(ii) Physical stock checking in stores to check quantity on hand of each part and material in order to verify the balances shown in stock on store records.
(iii) Standardising materials and parts for lowest cost manufacturing or purchasing.

(b) Three major steps are involved in the use of network scheduling technique:

- Planning the Project
  — Analyse the project by determining all the individual activities, and
  — Show the planned sequence of these activities on a network.

- Scheduling the Project
  — Estimate how long it will take to perform each activity,
  — Perform computations to locate the critical path. This information will also provide information for scheduling
  — Use this information to develop a more economical and efficient schedule.

- Monitoring the Project
  — Use the plan and schedule to control and monitor progress, and
  — Revise and update the schedule throughout execution of the project so that the schedule represents the current plans and current status of progress.

18.(a) A marketing Manager has 4 subordinates and 4 tasks. The subordinates differ in efficiency. The tasks also differ in their intrinsic difficulty. His estimates of the time each subordinate would take to perform each task are given in the matrix

	I	II	III	IV
1	16	52	34	22
2	26	56	8	52
3	76	38	36	30
4	38	52	48	20

How should the task be allocated one to one man so that the total man-hours are minimized?

(b)Write short note on Multiple Optimal Solutions in reference to assignment.

Answer:

(a)

Row reduction

	I	II	III	IV
1	0	36	18	6
2	18	48	0	44
3	46	8	6	0
4	18	32	28	0

Column reduction

	I	II	III	IV
1	0	28	18	6
2	18	40	0	44
3	46	0	6	0
4	18	24	28	0

Minimum lines to cut zeros

	I	II	III	IV
1	0	28	18	6
2	18	40	0	44
3	46	0	6	0
4	18	24	28	0

As the minimum number of lines are equal to order of matrix, optimal assignment should be made.

Optimal Assignment

	I	II	III	IV
1	[0]	28	18	6
2	18	40	[0]	44
3	46	[0]	6	0
4	18	24	28	[0]

		Time
1	I	16
2	III	8
3	II	38
4	IV	20
Total		82

(b) Sometimes, it is possible to have two or more ways to cross out all zero elements in the final reduced matrix for a given problem. This implies that there are more than the required numbers of independent zero elements. In such cases, there will be multiple optimal solutions with the same total cost of assignment. In such type of situations, management may exercise their judgment or preference and select that set of optimal assignments which is more suited to their requirement.

SECTION B – Information System

19. Explain the following terms in 2 or 3 sentences:

(a) Tampering with computer source documents
(b) Name big five of ERP market
(c) Database Design
(d) Database Administrator
(e) Regression Testing
(f) Tactical-level information
(g) Programmed decision making
(h) Commerce Net

Answer:

(i) Section 65 of Information Technology Amendment Act, 2008 deals with tampering with computer source documents. Knowingly or intentionally concealing, destroying, altering or causes to conceal, destroy or alter any computer source code when the same is required to be kept or maintained by law is an offence punishable with three years imprisonment or up to two lakhs rupees or with both.

(ii) ERP market during 1990, was dominated by few vendors namely SAP, BaaN, Oracle, People Soft and JD Edwards, who were also known as big five of ERP market. Key focus of ERP vendors, during that period, was to expand functional scope of their product and provide sharper vertical focus.

(iii) In database design the important issues involved are sub-systems in the organization and the logic of integration. Technical knowledge of database and knowledge of application systems, their control requirements and designing of reports are essential for efficient designing of database.

(iv) The DBA is responsible for authorizing access to the database, for coordinating and monitoring its use, and for acquiring software and hardware resources as needed. The DBA is accountable for problems such as breach of security or poor system response time.

(v) Regression Testing- As the software change, each time a new module is added as part of integration testing, the software changes. In the context of the integration testing, the regression tests ensure that changes or corrections have not introduced new errors.

(vi) Tactical-level information systems serve middle level managers and help in taking decisions for a period of 2-3 years. The managers are typically concerned with planning, controlling and use summaries of transactions to aid their decision-making.

(vii) Decisions which are of repetitive and routine nature are known as programmed decisions, for example, preparation of payroll and disbursement of pay through bank account are programmed decision. Generally guidelines and rules are already established for taking programmed decisions.

(viii) Commerce Net is a consortium of companies which is promoting the use of internet for E-commerce. Sponsored by Silicon Valley vendors and US Government agencies, it was launched with the aim of creating infrastructure for business-to –business transactions on the internet.

20. (a) What is System Testing?

(b) What are the different types of implementation strategies?
(c) What is Preliminary Investigation?

Answer:

(a) System Testing

When the software as a whole is operational, System testing begins. The types of testing that might be carried out are as follows:

- **Recovery Testing:** Recovery testing is the forced failure of the software in a variety of ways to verify that recovery is properly performed.
- **Security Testing:** The six basic security concepts that need to be covered by security testing are - confidentiality, integrity, authentication authorization, availability and non-repudiation.
- **Stress or Volume Testing:** It involves testing beyond normal operational capacity.
- **Performance Testing:** In the computer industry, software performance testing is used to determine the speed or effectiveness of a computer, network, software program or device.

(b) Four types of implementation strategies are as follows:

(i) **Direct Implementation / Abrupt change-over:** Conversion by direct change over means that on a specified date the old system is dropped and the new system is put into use . The users have no possibility of using the old system other than the new one. Adaptation is a necessity. The disadvantage is that as the old system is dropped and new system is put to use, there is no adequate way to compare new results with old ones.

(ii) **Phased implementation:** If each phase is successful then the next phase is started, eventually leading to the final phase when the new system fully replaces the old one. The advantage is that. It allows users to get involved with the system gradually. The disadvantage is that It takes too long to get the new system in place.

(iii) **Pilot implementation:** With this strategy, the new system replaces the old one in one operation but only on a small scale, it might be tried out in one branch of the company or in one location. When one operation is sucessfully completed, other conversions are done for other operations. Each module is thoroughly tested before being used. Users become familiar with each module as it becomes operational.

(iv) **Parallel running implementation :** The old system remains fully operational while the new systems come online, the old and the new system are both used alongside each other .If all goes well, the old system is stopped and new system carries on. The advantage is that there is a possibility of checking new data against old data in order to catch any errors in the processing of the new system. The disadvantage is that Cost of running two systems at the same time is high. The workload of employees during conversion is almost doubled.

(c) The basic objective of preliminary investigation is to outline the necessity of SDLC. It also analyse in terms of productivity gains, cost savings, and Intangible benefits like improvement in morale of employees.

The steps involved in the preliminary investigation phase are as follows:

(i) Identification of Problem
(ii) Identification of objective
(iii) Delineation of scope
(iv) Feasibility study

The following issues are typically answered in the Feasibility Study :

(i) Whether the existing system can rectify the situation without a major modification?
(ii) What is the time frame for which the solution is required?
(iii) What will be the approximate cost to develop the system?
(iv) Whether the vendor product offers a solution to the problem?

21.(a) Which areas of DBMS should be addressed while maintaining a database? Explain.
(b) What is the role of System Analyst?

Answer:

Following five areas of DBMS managements are be considered when trying to maintain a well-tuned database:

(i) Installation of database

- Correct installation of the DBMS product.
- Ensuring that adequate file space is available.
- Proper allocation of disc space for database.
- Allocation of data files in standard sizes for I/O balancing.

(ii) Memory Usage – One should know about following memory management issues:

- How the DBMS uses main memory?
- What buffers are being used?
- What needs the programs in main memory have?
- Knowledge of above issues can help in efficient usage of memory.

(iii) Input / Output (I/O) contention

- Achieving maximum I/O performance is one of the most important aspects of tuning. Understanding how data are accessed by end-users is critical to I/O contention.
- Simultaneous or separate use of input and / or output devices.
- Clock speed of CPU requires more time management of I/O.
- Spooling/Buffering etc. can be used.
- Knowledge of how many and how frequently data are accessed, concurrently used database objects need to be striped across disks to reduce I/O contention.

(iv) CPU Usage

- Multi programming and multi processing improve performance in query processing
- Monitoring CPU load.
- Mixture of online/back ground processing need to be adjusted.
- Mark jobs that can be processed in run off period to unload the machine during peak working hours.

(b) The role of System Analyst is:

- To analyze existing systems , procedures and documents
- To develop ideas for improved/new system
- To design system specifications with input, output and file specifications
- To design control system with audit trail
- To define actions/decisions/error messages under various conditions
- To prepare user and operations manual
- To prepare implementation plan(parallel/pilot/phased/direct switch over)
- To prepare program specifications with test data and monitoring results
- To provide guidance to programmers
- To make interaction with users.

22. (a) What is meant by RDBMS? Name two commonly used RDBMS.
(b) Write a short note on Data Independence.

Answer:

(a) In Relational Database Structures, records are stored in the form of two dimensional tables. The table is a file, in which each row represents one record and each column represents a field. In this database structure, relationships between the records need not

to be specified in advance. Relational databases provide the flexibility in performing database queries and creating reports from more than one file by establishing the relationship among them on the basis of primary key. This relationship among the files can be created at any time according to the requirement and need not to be specified at the time of creation of database files.

The relational database structure is more flexible than hierarchical or network database structures in providing answers of adhoc reports but it does not process the large batch applications with the speed of hierarchical or network databases.

Examples of Relational Database Management Systems include Oracle, IBM DB2 SQL Server, MS-Access etc.

(b) The three-schema architecture can be used to explain the concept of data independence, which can be defined as the capacity to change the schema at one level of a database system without having to change the schema at the next higher level. We can define two types of data independence:

(i) **Logical data independence** is the capacity to change the conceptual schema without having to change external schemas or application programs. We may change the conceptual schema to expand the database (by adding a record type or data item), or to reduce the database (by removing a record type or data item). In the latter case, external schemas that refer only to the remaining data should not be affected. For example, the external schema of Fig. 4(a) should not be affected by changing the GRAD_REPORT file shown in Fig. 2 into the one shown in Fig. 5(a). Only the view definition and the mappings need be changed in a DBMS that supports logical data independence. Application programs that reference the external schema constructs must work as before, after the conceptual schema undergoes a logical reorganization. Changes to constraints can be applied also to the conceptual schema without affecting the external schemas or application programs.

(ii) **Physical data independence** is the capacity to change the internal schema without having to change the conceptual (or external) schemas. Changes to the internal schema may be needed because some physical files had to be reorganized—for example, by creating additional access structures—to improve the performance of retrieval or update. If the same data as before remains in the database, we should not have to change the conceptual schema. For example, providing an access path to improve retrieval of SECTION records by Semester and Year should not require a query such as "list all sections offered in fall 1998" to be changed, although the query would be executed more efficiently by the DBMS by utilizing the new access path.

Whenever we have a multiple-level DBMS, its catalog must be expanded to include information on how to map requests and data among the various levels. The DBMS uses additional software to accomplish these mappings by referring to the mapping information in the catalog. Data independence is accomplished because, when the schema is changed at some level, the schema at the next higher level remains unchanged; only the mapping between the two levels is changed. Hence, application programs referring to the higher-level schema need not be changed.

The three-schema architecture can make it easier to achieve true data independence, both physical and logical. However, the two levels of mappings create an overhead during compilation or execution of a query or program,

leading to inefficiencies in the DBMS. Because of this, few DBMSs have implemented the full three-schema architecture.

23. What is prototyping approaches to systems development? What are its advantages and shortcomings?

Answer:

A Prototype is smaller version of system in terms of volume, complexity and cost. Prototyping technique is used to develop smaller systems such as decision support systems, management information systems and expert systems. The goal of prototyping approach is to develop a small or pilot version called a prototype of part or all of a system. A prototype is a usable system or system component that is built quickly and at a lesser cost, and with the intention of being modifying or replacing it by a full scale and fully operational system. Finally, when a prototype is developed that satisfies all user requirements, either it is refined and turned into the final system or it is scrapped. If it is scrapped, the knowledge gained from building the prototype is to develop the real system.
Prototyping consists of following four steps:

(i) **Identify Information System Requirements:** In traditional approach, the system requirements have to be identified before the development process start. However, under prototype, the process of determining them can be less formal and time-consuming than when performing traditional systems analysis.

(ii) **Develop the Initial Prototype:** In this step, the designers create an initial base model-for example, using fourth-general programming languages or CASE tools. The main goal of this stage is 'rapid development' and 'low cost'.

(iii) **Test and Revise:** After finishing the initial prototype, the designers first demonstrate the model to users for experiment. At the outset, users must be told that the prototype is incomplete and requires subsequent modifications based on their feedback. Thus, the designers ask users to record their likes and dislikes about the system and recommend changes. Using this feedback, the design team modifies the prototype as necessary and then resubmits the revised model to system user for reevaluation. Thus interactive process of modification and reevaluation continues until the users are satisfied-commonly, through four to six interactions.

(iv) **Obtain User Signoff of the Approved Prototype:** At the end of Step 3, users formally approve the final version of the prototype, which commits them to the current design and establishes a contractual obligation about what the system will, and will not do or provide.

Advantages of Prototyping

(i) Prototyping requires intensive involvement by the system users. Therefore, it typically results in a better definition of the users' needs and requirements than does the traditional system development approach.

(ii) A very short time period (e.g., a week) is normally required to develop and start experimenting with a prototype. This short time period allows system users to immediately evaluate proposed system changes.

(iii) Since system users experiment with each version of the prototype through an interactive process, errors are hopefully detected and eliminated early in the developmental process. As a result, the information system ultimately implemented should be more reliable and less costly to develop than when the traditional systems development approach is employed.

Disadvantages of Prototyping

(i) Prototyping can only be successful if the system users are willing to devote significant time in experimenting with the prototype and provide the system developers with change suggestions.

(ii) The interactive process of prototyping causes the prototype to be experimented with quite extensively. Because of this, the system developers are frequently tempted to minimize the testing and documentation process of the ultimately approved information system. Inadequate testing can make the approved system error-prone, and inadequate documentation make this system difficult to maintain.

(iii) Prototyping may cause behavioral problems with system users. These problems include dissatisfaction by users if system developers are unable to meet all user demands for improvements as well as dissatisfaction and impatience by user when they have to go through too many interactions of the prototype.

24. Explain the terms:
(a) Data Warehouse
(b) AI
(c) Firewall
(d) Flow Chart

Answer:

(a) The data warehousing is the concept of data integration by way specialized data storage and retrieval technique. The core of data warehousing is multi-dimensional databases. The basic objective of data warehousing is give right kind of expert analysis of data and feed the decision makers with right kind of information for effective decision to run the business efficiently.

The need for data warehousing has come from increased competition and demand for more and accurate information for precise decision making. Data warehousing can translate the data in common format and store them scientifically for faster access. Combining the related data is the crux in the approach of data warehousing. Thus, database design has a definite key role in making the storage efficient. Providing sensible information is only possible through analysis of related data.

Steps involved:
- Development of hardware and software infrastructure
- Building sound corporate database
- Establishment of communication network
- Managing smooth data flow from multiple operational points
- Building proper check and security measures from misuse

Critical factors involved in data warehousing:
- Heterogeneous data set and their translation in common format
- Organization of database
- Capability of software tool
- Judgement on transactional period for storage of data

Advantages:
- Effective, efficient and convenient data storage
- Elimination of duplication
- Lower storage of cost
- Faster navigation through related information
- Reliable data
- Consistency in reporting
- Better decision making

Strategic use of data warehousing in different business environments:
- Customer Service
- Sales Promotion
- Market analysis of new products

(b) Artificial Intelligence refers to behaviour of computer system which seems to be intelligence of the computer itself. As you know the computer does not have power to act on its own, the intelligent solutions from a computer system is termed to be Artificial Intelligence. In fact, this phenomena is exhibited by a computer system out of the expertise of the software which has the capability to interpret the problem situation and use the knowledge base to evolve intelligent solutions. The artificial intelligence is closely associated with expert system. It is only the expert system which can exhibit artificial intelligence.

(c) Firewalls offer an effective system to protect access by unauthorized user from outside. The main feature of firewall is packet-filtering router so that vital information does not pass to any unauthorized intruder, even if he manages get access to the network system. It is a system of security in the network with the help of hardware and software. A software checks all incoming and outgoing internet traffics. The firewall routes the massages to a safe area to avoid any danger in the in forward transmission of messages. The screening by firewall software may delay the transmission process but ensures proper security.

Limitations of Firewall
- Passing on information by internal employees through internet cannot be checked.
- Firewall cannot protect the system from virus.

(d) Flow Chart is the diagrammatic representation of the algorithm i.e. program logic. It uses a unique set of symbols to describe the conditions and actions.

Technique of in drawing flow chart
- Starting with the input for main decision factor
- Putting the condition in the decision box
- Branching the condition into different path of decision box
- Branching should be done without ambiguity
- To remove ambiguity, more than one decision box may be used

- Writing the statements under each branch
- Avoiding crosses in the flow chart
- Using connectors to reduce the number of flow lines, if required.

Advantages of Flow Charts:

- Logical representation of problem steps
- Flow chart helps to make the complex logic simpler
- A visual aid in conceptualization of the problem
- It is tool for efficient programming
- Helps in debugging
- Support program documentation

25. (a) Write the importance of Marketing Information System.
(b) What are the benefits of Business Intelligence (BI)
(c) What are the advantages of Coding?

Answer:

(a) Importance of Marketing Information System:

(i) Anticipation of Customer Demand- Every marketer needs up-to-date knowledge about consumer needs and wants.
(ii) Systematic Approach- Expanding markets and competitive marketing environment require adequate market intelligence system.
(iii) Economic indicator- Marketers must have latest information on the changing trends of supply, demand and prices.
(iv) Significance of Analysing Competition- Marketer cannot survive without having information regarding nature, character and size of competition to be met.
(v) Development of Technology- Marketers must have latest information regarding technological development.
(vi) Understanding the consumer- Information system can establish proper two way flow of information and understanding between marketers and consumer.
(vii) Marketing Planning- Marketing plans and programmes are based upon information supplied by economic forecasts and market research.

(b) Benefits of Business Intelligence (BI)

(i) Time savings
(ii) Single version of truth
(iii) Improved strategies and plans
(iv) Improved tactical decisions
(v) More efficient processes
(vi) Cost savings
(vii) Faster, more accurate reporting
(viii) Improved Decision making
(ix) Improved customer service
(x) Increased revenue

(c) Information is often coded because of the following advantages:

(i) It is quicker to enter into the computer
(ii) It require less disc space to store and less momory to process
(iii) It can make processing easier or possible as there will be fewer responses
(iv) It improves the consistency of the data as spelling mistakes are less likely

(v) Validation is easier to apply.

26.(a) Discuss the role of Internet in the development of E-commerce.
(b) What is the basic purpose of Inventory Management in any business enterprise?

Answer:

(a) Electronic commerce is the process of doing business electronically. It involves the automation of a variety of B2B and B2C transactions through reliable and secure connections. It is a composite of technologies, processes and business strategy that foster the instant exchange of information within and between organizations. It strengthens relationship with buyers. Makes it easier to attract new customers, improves customer responsiveness and opens new markets on global scale.
The internet provides an inexpensive and information rich, shared multimedia network technologies and make a dramatic impact on the scope of E-commerce. They are as follows:

(i) Universality: Any business using the Internet can interact with any other business using the Internet.
(ii) Reach: The Internet is everywhere,large cities and small towns throughout the modern and developing world.
(iii) Performance: The Internet provides its users with a high-function window to the world, in addition to handling everyday networking tasks such as electronic mail; and visual images, audio clips and other large electronic objects.
(iv) Reliability: Internet technology is highly robust and reliable as the design concepts for it came out of the U.S. Department of Defence.
(v) Cost: Internet costs are lower as compared to the alternative networking technologies.
(vi) Momentum: Tens of millions of individuals are already connected to the Internet and business use is increasing at a dramatic rate.

(b) Inventory Management is a component of Materials Management and is fully integrated with the entire logistic system. The basic purpose of Inventory Management in any business enterprise is:

(i) Management of material stock on quantity and value basis (stock may be inputs like Raw Materials, Stores & Spares. In process material, finished goods, scraps etc.)
(ii) Planning, Entry & Documentation of all Goods Movements
(iii) Physical Inventory (Stock Verification)
It is directly linked with Material Requirement Planning (MRP) which may be automatic or manual , purchasing and invoice Verification. It is also closely linked with Production Planning, Sales & Distribution, Quality Management and Plant Maintenance.

27. (a) State the steps involved in implementation of MIS.
(b) What are the eight basic features of an MIS?

Answer:

(a) For establishment of MIS in an organization, the following steps are followed :

Analytical study on information requirement: A joint efforts by systems experts and management experts is required to understand the exact need of information at different levels of management and how to assimilate them from data flow from different sources. The

anticipated change in the need of information may be kept in mind while planning the design in order to provide sufficient flexibility in the system.

Determine the sources of information: Once the first step is understood, it is to see how to get the required information and their sources. If required, data recording system may be changed at different points so that exact data flow is ensured and the same can be done without much hazards. For the sake of simplicity of the system reorientation in the physical flow of data has to be done.

Establishment of right kind of data processing environment: The important step involved in MIS designing is arranging the right kind of tools for processing i.e Computer System and infrastructure in terms of software and skilled manpower. The proper scheduling of processing is equally important to ensure smooth flow of information.

Selection of software: One of the important factors of success for MIS is quality of software. Software must fulfill the following criteria :
- Compatibility of hardware
- Capable of taking load of data volume
- Have the support of software for required database
- Capable of supporting the communication network
- Satisfy the design specification of system architecture – Central data processing or distributed data processing.

Database design : In database design the important issues involved are sub-systems in the organization and the logic of integration. Technical knowledge of database and knowledge of application systems, their control requirements and designing of reports are essential for efficient designing of database.

Support of top management : To ensure the smooth functioning of MIS top management support is required. Top management will support only when they are convinced about the benefit of MIS of the organization and confident of efficient performance of processing and regular reporting. Thus, for support of top management, efficiency of MIS has to be established.

Manpower: Arrangement of right kind of manpower with proper skill is the most consideration for successful operation of the system. Proper planning for training of manpower involved in transaction processing and report generation under an MIS system is required to take care of future development of the system.
Integration of information: At the time of designing the data bases, provision for integration of information from different sub-systems is essential so that comprehensive information flow can be of great use for strategic planning.

Evaluation, maintenance and Control: The effectiveness of an MIS system is evaluated by the capacity of its fulfillment of requirement of information by the management. Evaluation is done by ascertainment of the views of the users. Maintenance is needed to take care of the gaps, if any, for further growth and for regular smooth functioning of the system. Control means establishment of checks for input data, processing and output to ensure correctness of reports. Proper maintenance and control on effective operation of MIS required to ensure protection from hazards and smooth functioning on a routine basis.

(b) Basic features of an MIS:

(i) Management Oriented – It means the effort for development of the information system should start from an appraisal of management needs and overall business objectives.
(ii) Integrated – Development of Information should be an integrated one. It means all the functional and operational information sub-system should be tied together into one entity.
(iii) Reliability – MIS system should provide most reliable information. A thorough check of input information, process flow and output reports on regular and routine basis
(iv) Flexibility – MIS should be flexible enough to take care of changes in the environment in the business system.
(v) Consistency- The input data and output reports must follow some standard norms so that consistency is preserved.
(vi) Timeliness – One of the most important issues involved in the effectiveness of MIS are flow of information at right time to the user level of management.
(vii) Relevance – Only relevant information should flow at different levels of management to increase the effectiveness of MIS.
(viii) Simplicity – An MIS System should be as simple as possible so that people at operation and users do not feel any hazards. The success of a system lies in the acceptance by operation staff and users.

28. (a) Explain the working principle of Electronic Data Interchange (EDI).
(b) What are the major features of ERP?

Answer:

(a) Electronic Data Interchange (EDI): EDI is the transmission of business information in standard format between computers of independent organizations. There is no need to change the database structure by the companies for implementation of EDI. However, EDI software is required to be developed for translating the format used by one organization to the format being used by another organizations. So EDI is computer-to-computer communication using a standard data format to exchange business information electronically between independent organizations.

Working Principle of EDI – EDI is the electronic exchange of business documents such as invoices, purchase orders, shipping notices etc. EDI is a three step process :-
i. First of all, sender data is converted into standard format as defined by EDI translation software.
ii. Data in standard format is transferred to the receiver using communication lines.
iii. Finally, standard format data is converted according to the format of receiver data base files.

EDI consists of three components:

(i) Communication - To make EDI work, one needs communication software, translation software and access to standards. Communication software moves data from one point to another, flags the start and end of the document. Translation software helps the user to build a map and shows him how the data fields from his application corresponds to the elements of EDI standards. It also converts data back and forth between the application format and the EDI format.
(ii) Mapping - To build a map, the user first selects the EDI standard for the kind of data he wants to transmit. Usually the trading partner tells about the kind of standards to be used. Next, he edits out parts of the standards, which do not apply, to his application. Next, he imports a file that defines the fields in his application, and finally he makes the map to show where the data required by the EDI standards

is located in his application. Once the map is built, the translator will refer to it during EDI processing every time a transaction of that type is sent or received.

(iii) Profile - The last step is to write a partner profile that tells the system where to send each transaction and how to handle errors or exceptions. Whereas the user needs a unique map for every kind of documents he exchanges with a partner, he should only have to define partner information once.

(b) Major features of ERP:

(i) ERP provides multi-platform, multi-mode, manufacturing, multi-currency, multi-lingual facilities.
(ii) It supports strategic and business planning activities, operational planning and execution activities, creation of materials and resources. All these functions are effectively integrated for flow and update of information immediately upon entry of any information.
(iii) Has end to end supply chain management to optimize the overall demand and supply data.
(iv) ERP facilitates company-wide integrated information system covering all functional areas like manufacturing, selling and distribution, payables, receivables, inventory accounts, human resources, purchases etc.
(v) ERP performs core activities and increases customers service, thereby augmenting the corporate image.
(vi) ERP bridges the information gap across organizations.
(vii) ERP provides complete integration of systems not only across departments but also across companies under the same management.
(viii)ERP is the solution for better project management.
(ix)ERP allows automatic introduction of the latest technologies like Electronic fund transfer, Electronic data interchange, Internet, Intranet, Video Conferencing, E-commerce etc.
(x)ERP eliminates most business problems like materials shortages, productivity enhancements , customer service cash management, inventory problems, quality problems, prompt delivery etc.
(xi)ERP provides intelligent business tools like decision support systems, executive information system, data mining and easy working systems to enable better decisions.

29. What are the conditions subject to which electronic record may be authenticated by means of affixing digital signature?

Answer:

Chapter-II of Information Technology (Amendment) Act 2008 gives legal recognition to electronic records and digital signatures. It contains only section 3.
This Section deals with the conditions subject to which an electronic record may be authenticated by means of affixing digital signature which is created in two definite steps. First the electronic record is converted into a message digest by using a mathematical function known as "Hash function" which digitally freezes the electronic record thus ensuring the integrity of the content of the intended communication contained in the electronic record. Any tampering with the contents of the electronic record will immediately invalidate the digital signature. Secondly, the identity of the person affixing the digital signature is

authenticated through the use of a private key which attaches itself to the message digest and which can be verified by anybody who has the public key corresponding to such private key. This will enable anybody to verify whether the electronic record is retained intact or has been tampered with since it was so fixed with the digital signature. It will also enable a person who has a public key to identify the originator of the message.

For the purposes of this sub-section, "hash function" means an algorithm mapping or translation of one sequence of bits into another, generally smaller set known as "hash result" such that an electronic record yields the same hash result every time the algorithm is executed with the same electronic record as its input making it computationally infeasible to derive or reconstruct the original electronic record from the hash result produced by the algorithm; that two electronic record can produce the same hash result using the algorithm.

30. Explain 'Electronic Governance' with reference to " Information Technology (Amendment) Act,2008.

Answer:

It specifies the procedures to be followed for sending and receiving of electronic records and the time and the place of the dispatch and receipt.

Section 4 provides for 'legal recognition of electronic records'. It provides that where any law requires that any information or matter should be in the typewritten or printed form then such requirement shall be deemed to be satisfied if it is in an electronic form.

Section 5 provides for legal recognition of Digital Signature. Where any law requires that any information or matter should be authenticated by affixing the signature of any person, then such requirement shall be satisfied if it is authenticated by means of Digital Signature affixed in such manner as may be prescribed by the Central Government.

For the purpose of this section . 'signed' , with its grammatical variations and cognate expressions, shall with reference to aperson , mean affixing of his hand written signature or any mark on any document and the expression "signature" shall be construed accordingly.

Section 6 lays down the foundation of Electronic Governance. It provides that the filing of any form, application or other documents, creation, retention or preservation of records, issue or grant of any licence or permit or receipt or payment in Government offices and its agencies may be done through the means of electronic form. The appropriate Government office has the power to prescribe the manner and format of the electronic records and the method of payment of fee in that connection.

Section 7 provides that the documents, records or information which is to be retained for any specified period shall be deemed to have retained if the same is retained in the electronic form provided the following conditions are satisfied:

(i) The information therein remains accessible so as to be usable subsequently.

(ii) The electronic record is retained in its original format or in a format which accurately represents the information contained.

(iii) The details which will facilitate the identification of the origin, destination, dates and time of dispatch or receipt of such electronic record are available therein.

This section does not apply to any information which is automatically generated solely for the purpose of enabling an electronic record to be dispatched or received.

Moreover, this section does not apply to any law that expressly provides for the retention of documents, records or information in the form of electronic records.

Section 8 provides for the publication of rules, regulations and notifications in the Electronic Gazette. It provides that where any law requires the publication of any rule,regulation, order, bye-law, notification or any other matter in the Official Gazette, then such requirement shall be deemed to be satisfied if the same is published in an

electronic form.It also provides where the Official Gazette is published both in the printed as well as in the electronic form, the date of publication shall be the date of publication of the official gazette which was first published in any form.