# PAPER- 9 Operations Management & Information Systems

**1. (a) The demand for sewing machine was estimated as 1000 per month for 5 months. Later on the actual demand was found as 900, 1050, 1000, 1100 and 950 respectively. Workout Bias.**

**Answer:**

$$\text{Bias} = \frac{(1000-900)+(1000-1050)+(1000-1000)+(1000-1100)+(1000-950)}{5}$$

$$= \frac{100-50+0-100+50}{5}$$

= 0 units of sewing machines.

**(b) Monthly demand for a component 8,000 units. Setting –up cost per batch ₹ 120. Cost of manufacture per unit ₹ 40. Rate of interest 10% P.a. Calculate the EBQ.**

**Answer:**

**Calculation of EBQ:**

**EBQ =** $\sqrt{\frac{2\times 12\times 8,000\times 120}{0.1\times 40}}$ = 2,400 units.

**(c) Define Standardisation.**

**Answer:**

**Standardisation** refers to design activity that reduces variety among a group of products or parts. This will result in higher volume for each product or part model which can lead to lower production costs, higher product quality and lower inventory and higher ease of automation.

**(d) Who is a Qualified Worker?**

**Answer:**

A qualified worker is one who is accepted as having the necessary physical attributes, possessing the required intelligence and education and having acquired the necessary skill and knowledge to carry out the work in hand to satisfactory standards of safety, quantity and quality.

**(e) Define P-D-C-A Cycle.**

**Answer:**

P - Plan (process) the improvement
D - Do implement the plan
C- Check- check hoe closely result meets goals
A- Act- use the improved process as standard practice

**(f) The main shaft of an equipment has a very high reliability of 0.980.The equipment comes from Japan and has a very high downtime cost associated with the failure of this shaft. This is estimated at ₹2 crores as the cost of sales lost and other relevant costs. However, this spare is quoted at ₹10 lakh at present. Should the shaft spare be procured along with the equipment and kept or not?**

**Answer:**
The expected cost of down-time
= (Probability of failure) x (Cost when break-down occurs)
= (1 – 0.980) x (₹2 crores)
= ₹4 lakhs

**(g) Define Expert System.**

**Answer:**
An Expert system is a knowledge based system which acts an expert in devising solutions. An expert system acts in a specific area only with the support of knowledge database on this specific area.. Knowledge database means structured information stored on previous experience which is stored in a database. Even the present solution devised from the system and the information on its outcome will also be stored.

**(h) What is Query Language?**

**Answer:**
A high-level DML used in a stand-alone interactive manner is called query language. In general, both retrieval and update commands of a high-level DML may be used interactively and are hence considered part of the query language.

**(i) Define Credit Control**

**Answer:**
An important feature of this module is to monitor invoices overdue for payment and generate reminder letters for sending to customers. In case the invoice is still not paid, increasingly urgent reminders are generated in the system subsequently at a predefined interval. The system also maintains a credit diary, which contains details of all unpaid invoices whether due for payment or not.

**(j) List the uses of Electronic Data Interchange(EDI).**

**Answer:**
EDI is used in following ways:
1. EDI is used to electronically transfer documents such as purchase order, invoices, shipping notices, receiving advises and other standard business correspondence between the trading partners.
2. EDI can also be used toi transmit financial information and payment in electronic form. However, where EDI is used for effecting payment it is commonly known as financial EDI or electronic fund transfer.

## SECTION A - OPERATION MANAGEMENT

**Study Note — 1(Operations Management & Designing and Managing Operations)**

**2. (a) Discuss about the principal customer wants.**
**(b) State the characteristics of good product design.**
**(c) 'Modular design and designing for automation are two aspects of designing for ease of production.'- Justify.**

**Answer:**

**(a)**

| **Principal customer wants** | | |
|---|---|---|
| **Principal function** | **Primary consideration** | **Other consideration** |
| Manufacture | Goods of a given, requested or acceptable specification | Cost i.e. purchase price or cost of obtaining goods<br>timing, i.e. delivery delay from order or request to receipt of goods |
| transport | Movement of a given, requested or acceptable specification | Cost, i.e. cost of<br>movement timing ,i.e.<br>(i) duration or time to move<br>(ii) wait, or delay from requesting to its commencement |
| supply | Goods of a given, requested or acceptable specification | Cost, that is purchase price or cost obtaining goods<br>timing, i.e. delivery delay from order or request to supply, to receipt of goods |
| service | Treatment of a given, requested or acceptable specification | Cost, i.e. cost<br>of treatment<br>timing, i.e.<br>(i) Duration or timing required for treatment<br>(ii) wait, or delay from requesting to its commencement |

**(b)**

A good product design must ensure the following:

**(i) Function or performance:** The function or performance is what the customer expects the product to do to solve his/her problem or offer certain benefits leading to satisfaction. For example, a customer for a motor bike expects the bike to start with a few kicks on the kick peddle and also expects some other functional aspects such as pick-up, maximum speed, engine power and fuel consumption etc.

**(ii) Appearance or aesthetics:** This includes the style, colour, look, feel, etc. which appeals to the human sense and adds value to the product.

**(iii) Reliability:** This refers to the length of time a product can be used before it fails. In other words, reliability is the probability that a product will function for a specific time period without failure.

**(iv) Maintainability:** Refers to the restoration of a product once it has failed. High degree of maintainability is desired so that the product can be restored (repaired) to be used within a short time after it breaks down. This is also known as serviceability.

**(v) Availability:** This refers to the continuity of service to the customer. a product is available for use when it is in an operational state. Availability is a combination of reliability and maintainability. High reliability and maintainability ensures high availability.

**(vi) Productibility: T**this refers to the ease of manufacture with minimum cost (economic production).This is ensured in product design by proper specification of tolerances, use of materials that can be easily processed and also use of economical processes and equipments to produce the product quickly and at a cheaper cost.

**(vii) Simplification:** This refers to the elimination of the complex features so that the intended function is performed with reduced costs, higher quality or more customer satisfaction. A simplified design has fewer parts which can be manufactured and assembled with less time and cost.

**(viii) Standardisation:** Refers to the design activity that reduces variety among a group of products or parts. for example, group technology items have standardised design which calls for similar manufacturing process steps to be followed. standard designs lead to variety reduction and results in economies of scale due to high volume of production of standard products. However, standardised designs may lead to reduced choices for customers.

**(ix) Specification:** A specification is a detailed description of a material, part or product, including physical measures such as dimensions, volume, weight, surface finish etc. These specifications indicate tolerances on physical measures which provide production department with precise information about the characteristics of products to be produced and the processes and production equipments to be used to achieve the specified tolerances (acceptable variations).

Interchangeability of parts in products produced in large volumes (mass production and flow- line production) is provided by appropriate specification of tolerances to facilitate the desired fit between parts which are assembled together.

**(x) Safety:** The product must be safe to the user and should not cause any accident while using or should not cause any health hazard to the user. safety in storage, handling and usage must be ensured by the designer and a proper package has to be provided to avoid damage during transportation and storage of the product. for example, a pharmaceutical product while used by the patient, should not cause some other side effect threatening the user.

**(c)**

**Designing for Production** (i.e., for ease of manufacturer and assembly) was discussed in the previous section. This can reduce the sources of error and improve overall product quality.

Modular design and designing for automation are two aspects of designing for ease of production.

**(i) Modular Design** is the creation of products from some combination of basic, prexisting subsystems known as **modules**. in this approach, products are designed in easily segmented components or modules. This design offers flexibility to both production (manufacture and assembly) and marketing. the modular design concept gives consumers a range of product options and offers considerable advantages in manufacturing and product design. stabilising the designs of the modules makes them easier to build. even the maintenance or repair of products in case of break down becomes easier because the faulty module can be easily removed and replaced by a spare module,

**(ii) Designing for Automation:** in designing for automation, three broad issues affecting product design efforts come into play. They are:

- wasteful or unnecessary processes should not be automated,
- simplify the design before automation,
- the process may be simplified to such an extent that automation may not be needed.

**3. (a) Write short note on the following:**
**(i) Computer Aided Design**
**(ii) Value Analysis**
**(iii) Delayed Differentiation**
**(b) 'Four generic components of Technological innovation are: basic research, applied research, development and implementation.'- Define the terms.**

**Answer:**

**(a)**

**(i) Computer Aided Design:** Computers are increasingly used for product design. CAD uses computer graphics for product design. the designers can modify an existing design or create a new design on a computer monitor screen by means of a keyboard or a joy stick. The design can be maneuvered on the screen, it can be rotated to provide the designer different views of the product, it can be split apart to have a view of the inside and a position of the product can be enlarged for closer view. the printed version of the completed design can be taken and also the design can be stored electronically. a number of products such as printed circuit boards, transformers, automobile parts, aircraft parts etc. can be designed using CAD.

CAD increases the productivity of designers from 3 to 10 times and preparing mechanical drawings of product or parts and modifying them frequently becomes easier. Also a data base can be created for manufacturing which can supply required information on product geometry and dimensions, tolerances, material specifications etc. Also, some CAD systems facilitate engineering and cost analyses on proposed designs, for example, calculation of volume and weight and also stress analysis can be done using CAD systems. it is possible to generate a number of alternative designs using computer aided design systems and identify the best alternative which meets the designer's criteria.

**(ii) Value Engineering/Value Analysis in Product Design:** Value engineering or value analysis is concerned with the improvement of design and specifications at various stages such as research, development, design and product development. Benefits of value engineering are:

- Cost reduction.
- Less complex products.
- Use of standard parts/components.
- Improvement in functions of the product.
- Better job design and job safety.
- Better maintainability and serviceability.
- Robust design.

Value engineering aims at cost reduction at equivalent performance. It can reduce costs to the extent of 15% to 70% without reducing quality. While value engineering focuses on preproduction design improvement, value analysis, a related technique seeks improvements during the production process.

Once launched, even good products have limited lives and, to remain viable, the organization
seeks a flow of new product possibilities. Let's examine the product's birth-to-mortality pattern.

**(iii) Delayed Differentiation** is the process of producing but not quite completing, a product, postponing completion until customer preferences or specifications are known. Modular design is a form of standardisation in which component parts are grouped into modules that are easily replaced or interchanged to produce varieties of the same basic product. One example is a computer system in which a customer can choose a particular configuration depending on the computing, capability desired by the customer. Modular design help mass customisation.

**(b)** Four generic components of technological innovation are: basic research, applied research, development, and implementation.

•Basic research is research for the advancement of scientific knowledge that has no specific commercial uses. Basic research may, however, be in the field of present or potential interest to the company.

•Applied research is research for the advancement of scientific knowledge that has specific potential commercial uses.

•Development is technical activity concerned with translating basic or applied research results into products or processes.

•Implementation is activity concerned with designing and building pilot models, equipment, and facilities, and initiating the marketing channels for products or services emerging from research and development.

**4. (a) Define Vertical Integration. Also state the advantages and disadvantages.**
**(b) Explain the term Buffering.**
**(c) Define value-added time.**

**Answer:**

**(a)** Vertical integration is the amount of the production and distribution chain, from suppliers of components to the delivery of products/services to customers, which is brought under the

ownership of a firm. The management decides the level or degree of integration by considering all the activities performed from the acquisition of raw materials to the delivery of finished products to customers. The degree to which a firm decides to be vertically integrated determines how many production processes need to be planned and designed to be carried out in-house and how many by outsourcing. When managers decide to have more vertical integration, there is less outsourcing. the vertical integration is based on **"make-or-buy" decisions**, with **make** decisions meaning more integration and a **buy** decision meaningless integration and more outsourcing. two directions of vertical integration are (a) **Backward integration** which represents moving upstream toward the sources of raw materials and parts, for example a steel mill going for backward integration by owning iron ore and coal mines and a large fleet of transport vehicles to move these raw materials to the steel plant, (b) **Forward integration** in which the firm acquires the channel of distribution (such as having its own warehouses, and retail outlets).

**Advantages of vertical integration are:**

- Can sometimes increase market share and allow the firm enter foreign markets more easily.
- Can achieve savings in production cost and produce higher quality goods.
- Can achieve more timely delivery.
- Better utilisation of all types of resources.

**Disadvantages of vertical integration are:**

- Not attractive for low volumes.
- High capital investment and operating costs.
- Less ability to react more quickly to changes in customer demands, competitive actions and new techniques.

**(b) Buffering** refers to a storage area between stages where the output of a stage is placed prior to being used in a downstream stage. Buffering allows the stages to operate independently. if one stage feeds a second stage with no intermediate buffer, then the assumption is that the two stages are directly linked.

**(c) Value-added time** is the time in which useful work is actually being done on the unit. assuming that all of the activities that are included in the process are value-added activities, value- added time should be the sum of the activity operation times in the process.

## Study Note — 2 (Production Planning)

**5. Alex Glass Company can produce a certain insulator on any three machines which have the following charges shown below. The firm has an opportunity to accept an order for either (1) 50 units at ₹ 20/unit or (2) 150 units at ₹ 12/unit.**

| Machine | Fixed cost (₹) | Variable Cost (₹) |
|---|---|---|
| A | 50 | 4/unit |
| B | 200 | 2/unit |
| C | 400 | 1/unit |

**(i) Which machine should be used if 50 units order is accepted and how much profit will result?**

**(ii) Which machine should be used if the 150 units order is accepted and what will be the resultant profit?**

**(iii) What is the break even volume for machine B when the price is ₹ 12/unit?**

**(iv) Suppose the fixed cost for machine A is a stepped function with ₹50 up to 40 units and ₹100 thereafter. Will the answers to (i) and (ii) above vary? If so, what will be the revised answer?**

**Answer:**

**(i)**

| | A (₹) | B (₹) | C (₹) |
|---|---|---|---|
| Revenue (50 x 20) | 1,000 | 1,000 | 1,000 |
| Cost: Variable | 200 (50 × 4) | 100 (50 × 2) | 50 (50 × 1) |
| Fixed Cost | 50 | 200 | 400 |
| Profit | 750 | 700 | 550 |

**Machine A should be suggested as profit is maximum i.e. ₹750.**

**(ii)**

| | A (₹) | B (₹) | C (₹) |
|---|---|---|---|
| Revenue(150 × 12) | 1,800 | 1,800 | 1,800 |
| Cost: Variable | 600 | 300 | 150 |
| | (150 × 4) | (150 × 2) | (150 × 1) |
| Fixed Cost | 50 | 200 | 400 |
| | 1,150 | 1,300 | 1,250 |

**Machine B should be suggested as profit is 1,300 which is highest.**

**(iii) For Machine B**

Fixed Cost – 200

Variable Cost – 2

Selling Price – 12 per unit

Let 'B' be the break even volume, then

Total Cost = Fixed Cost + (Variable Cost × Break even units)

Total Cost = 200 + 2B

Sales Revenue = Selling price × unit

= 12B

For B to be Break even

Sales Revenue = Total Cost

12B = 200 + 2B

B = 20

**(iv) For Machine A**

| | 50 units | 150 units |
|---|---|---|
| Revenue (50 × 20) | 1,000(50 × 20) | 1,800(150 × 12) |
| Cost: Variable | 200 (50 × 4) | 600(150 × 4) |
| Fixed Cost (upto 40 units 50 above 40 units 100) | 150 | 150 |
| Profit | 650 | 1,050 |

For case (i) above , in place of Machine A, Machine B would be suggested as profit is ₹700 which is highest.

For case (ii) above, the answer will remain same.

**6. (a) It is observed that there exists a relationship between Expenditure on Advertising and the Annual Sales. The details for last six years are as follows:**

| Year | Expenditure on Advertising (₹ Crore) | Annual Sales (₹ Crore) |
|---|---|---|
| **2004** | **1** | **18** |
| **2005** | **2** | **23** |
| **2006** | **4** | **32** |
| **2007** | **3** | **28** |
| **2008** | **10** | **38** |
| **2009** | **4** | **29** |

**Estimate the Annual sales when Expenditure on Advertising is ₹5 Crore.**

**(b) A manufacturer's study of various locations has found that the following costs vary from one location to another. The firm will finance the new plant from deposits bearing 5% interest. Determine the most suitable location for a sales volume of 20000 units/year.**

| Location | A | B | C |
|---|---|---|---|
| **Revenue (₹ per unit)** | **16.00** | **25.00** | **12.00** |
| **Labour (₹ per unit)** | **0.50** | **1.00** | **0.80** |
| **Plant (₹ Crore)** | **0.25** | **0.35** | **0.45** |
| **Material & Equipment* (₹ per unit)** | **0.20** | **0.50** | **0.25** |
| **Electricity (₹ p.a. '000)** | **25.00** | **28.00** | **30.00** |
| **Water (` p.a. '000)** | **7.00** | **5.00** | **4.00** |
| **Transportation (₹ per unit)** | **0.01** | **0.05** | **0.10** |
| **Taxes (₹ p.a. '000)** | **22.00** | **15.00** | **30.00** |

*** This cost includes a projected depreciation, but no interest.**

**Answer:**

**(a)**

| Year | Expenditure on Advertising ( Crore) | Annual Sales (y) ( Crore) | $(x^2)$ | xy |
|---|---|---|---|---|
| 2004 | 1 | 18 | 1 | 18 |
| 2005 | 2 | 23 | 4 | 46 |
| 2006 | 4 | 32 | 16 | 128 |
| 2007 | 3 | 28 | 9 | 84 |
| 2008 | 10 | 38 | 100 | 380 |
| 2009 | 4 | 29 | 16 | 116 |
| Total | $\sum x = 24$ | $\sum y = 168$ | $\sum x^2 = 146$ | $\sum xy = 772$ |

From the above

$\bar{X} = \frac{24}{6} = 4$ , $\bar{Y} = \frac{168}{6} = 28$

Let us assure the relationships is as under:

$Y = a + bx$

$\sum y = \sum a + b\sum x$

$168 = 6a + 24b$……(i)

$Xy = ax + bx^2$

$\sum xy = a\sum x + b\sum x^2$

$772 = 24a + 146b$ ……(ii)

Multiplying equation (i) by 4

$24a + 96b = 672$

$$\begin{array}{r} 24a + 146b = 772 \\ \hline -50b = 100 \end{array}$$

$b = 2$

$\sum y = 6a + 24b$

$168 = 6a + 24 \times 2$

$6a = 168 - 48 = 120$

$a = 20$

Relationship is $Y = 20 + 2x$

Hence, when $x = 5$, y will be

$Y = 20 + 2 \times 5 = 30$ Crores.

**(b)**

We get from the table given in the question

| **Costs** | **A (₹)** | **B (₹)** | **C (₹)** |
|---|---|---|---|
| F.C. (per annum) | | | |
| 5% of Investment | 1,25,000 | 1,75,000 | 2,25,000 |
| (Plant) | 25,000 | 28,000 | 30,000 |
| Electricity | 7,000 | 5,000 | 4,000 |
| Water | 22,000 | 15,000 | 30,000 |
| Taxes | 1,79,000 | 2,23,000 | 2,89,000 |
| Total Fixed Cost | | | |

**Variable Cost:**

| | **A (₹)** | **B (₹)** | **C (₹)** |
|---|---|---|---|
| Labour | 0.50 | 1.0 | 0.80 |
| Material | 0.20 | 0.50 | 0.25 |
| Transport | 0.01 | 0.05 | 0.10 |
| TVC per unit | 0.71 | 1.55 | 1.15 |
| TVC for 20000 units | 14,200 | 31,000 | 23,000 |
| Total FC | 1,79,000 | 2,23,000 | 2,89,000 |
| Total Cost | 1,93,200 | 2,54,000 | 3,12,000 |
| Total Revenue | 3,20,000 | 5,00,000 | 2,40,000 |

| | | | |
|---|---|---|---|
| Profit/Loss | 1,26,800 | 2,46,000 | (72,000) |

Location B is suitable.

**7. (a) An international tourist company deals with the numerous personals calls each day and prides itself on its level of service. The time to deal with each caller depends on the client's requirements which range from, say, a request for a brochure to booking a round-the-world cruise. If a client has to wait for more the 10 minutes for attention, it is company's policy for the manager to see him personally and to give him a holiday voucher worth ₹ 15.**

**The company's observations have shown that the time taken to deal with the clients and arrival pattern of their calls follow the following distribution pattern:**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Time to deal with clients** | **Minutes** | **2** | **4** | **6** | **10** | **14** | **20** | **30** |
| | **Probability** | **0.05** | **0.10** | **0.15** | **0.30** | **0.25** | **0.10** | **0.05** |

| | | | | | |
|---|---|---|---|---|---|
| **Time between call arrivals** | **Minutes** | **1** | **8** | **15** | **25** |
| | **Probability** | **0.2** | **0.4** | **0.3** | **0.1** |

**Required**

**(i) Describe how you would stimulate the operation of the travel agency based on the use of random number tables.**

**(ii) Simulate the arrival and serving of 12 clients and show the number of clients who receive a voucher (Use line 1 of the random numbers below to derive the arrival pattern and line 2 for the serving times); and**

**Random numbers**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Line 1** | **03** | **47** | **43** | **73** | **86** | **36** | **96** | **47** | **36** | **61** | **46** | **98** |
| **Line 2** | **63** | **71** | **62** | **33** | **26** | **16** | **80** | **45** | **60** | **11** | **14** | **10** |

**(b) A refreshment centre in a railway station has two counters - (i) Self-service - opted by 60% of the customers and (ii) attended service (opted by 40% of the customers). Both counters can serve one person at a time. The arrival rate of the customers is given by the following probability distribution:**

| | | | | | |
|---|---|---|---|---|---|
| **No. of arrivals** | **1** | **3** | **4** | **0** | **2** |
| **Probability** | **0.10** | **0.30** | **0.05** | **0.20** | **0.35** |

**Formulate the associated interval of 2 digit random numbers for generating (i) type of service and (ii) arrival rate.**

**Answer:**

**(a)**

(i) Probability Distribution (Arrival)

| Time between call arrivals | Probability | Cum. Probability | Range | Range for simulation |
|---|---|---|---|---|
| 1m | 0.20 | 0.20 | 0-0.20 | 0 – 0.19 |
| 8m | 0.40 | 0.60 | 0.20-0.60 | 0.20-0.59 |
| 15m | 0.30 | 0.90 | 0.60-0.90 | 0.60-0.89 |
| 25m | 0.10 | 1.00 | 0.90-1.00 | 0.90-0.99 |

(ii) Probability Distribution (Time to deal with client)

| Time to deal with clients | Probability | Cum. Probability | Range | Range for simulation |
|---|---|---|---|---|
| 2m | 0.05 | 0.05 | 0-0.05 | 0 – 0.04 |
| 4m | 0.10 | 0.15 | 0.05-0.15 | 0.05-0.14 |
| 6m | 0.15 | 0.30 | 0.15-0.30 | 0.15-0.29 |
| 10m | 0.30 | 0.60 | 0.30-0.60 | 0.30-0.59 |
| 14m | 0.25 | 0.85 | 0.60-0.85 | 0.60-0.84 |
| 20m | 0.10 | 0.95 | 0.85-0.95 | 0.85-0.94 |
| 30m | 0.05 | 1.00 | 0.95-1.00 | 0.95-0.99 |

(ii)

| Client S. No. | Call Arrival time | Service begins | Service time | Service completes | Waiting time |
|---|---|---|---|---|---|
| 1 | 0.01 | 0.01 | 0.14 | 0.15 | Nil |
| 2 | 0.09 | 0.15 | 0.14 | 0.29 | 6m |
| 3 | 0.17 | 0.29 | 0.14 | 0.43 | 12m |
| 4 | 0.32 | 0.43 | 0.10 | 0.53 | 11m |
| 5 | 0.47 | 0.53 | 0.06 | 0.59 | 6m |
| 6 | 0.55 | 0.59 | 0.06 | 1.05 | 4m |
| 7 | 1.20 | 1.20 | 0.14 | 0.34 | Nil |
| 8 | 1.28 | 1.34 | 0.10 | 1.44 | 6m |
| 9 | 1.36 | 1.44 | 0.14 | 1.58 | 8m |
| 10 | 1.51 | 1.58 | 0.04 | 2.02 | 7m |
| 11 | 1.59 | 2.02 | 0.04 | 2.06 | 3m |
| 12 | 2.24 | 2.24 | 0.04 | 2.28 | Nil |

**(b)**

Probability distribution (Type of service)

| | Probability | Cum. Prob. | Range | Range for simulation |
|---|---|---|---|---|
| Self-service | 0.60 | 0.60 | 0-0.60 | 0-0.59 |
| Attended service | 0.40 | 1.00 | 0.60-1.00 | 0.60-0.99 |

Probability distribution (Arrival rate)

| No. of arrivals | Probability | Cum. Prob. | Range | Range for simulation |
|---|---|---|---|---|
| 0 | 0.20 | | 0.20 | 0 - 0.20 |
| 1 | 0.10 | | 0.30 | 0.20 - 0.30 |

| | | | | |
|---|---|---|---|---|
| 2 | 0.35 | | 0.65 | 0.30 - 0.65 |
| 3 | 0.30 | | 0.95 | 0.65 - 0.95 |
| 4 | 0.05 | | 1.00 | 0.95 - 1.00 |

**8. (a) A farm is engaged in breeding pigs. The pigs are fed on various products grown on the farm. In view of the need to ensure certain nutrient constituents (call them as X, Y and Z). It becomes necessary to two additional products say A and B. One unit of A contains 36 units of X, 3 units of Y and 20 units of Z. One unit of B contains 6 units of X, 12 units of Y and 10 units of Z. The minimum requirement of X, Y and Z is 108 units, 36 units and 100 units respectively. Product A costs ₹ 20 per unit and product B costs ₹ 40 per unit. Formulate LPP to minimize the total cost.**

**(b) An oil refinery can blend three grades of crude oil to produce quality A and quality B petrol. Two possible blending processes are available. For each production run, the older process uses 5 units of crude Q, 7 units of crude P and 2 units of crude R and produces 9 units of A and 7 units of B. The newer process uses 3 units of crude Q, 9 units of crude P and 4 units of crude R to produce 5 units of A and 9 units of B. Because of prior contract commitments, the refinery must produce at least 500 units of A and at least 300 units of B for the next month. It has 1,500 units of crude Q, 1,900 units of crude P and 1,000 units of crude R. For each unit of A, refinery receives ₹ 60 while for each unit of B it receives ₹ 90. Formulate the problem as linear programming model so as to maximize the revenue.**

**Answer:**

**(a)**

Let's purchase x units of A and y units of B

Objective function : Z = Minimize $20x + 40y$

Subject to:

$36x + 6y \geq 108$

$3x + 12y \geq 36$

$20x + 10y \geq 100$

$x, y, z \geq 0$

**(b)**

Working note

| | Q | P | R |
|---|---|---|---|
| Requirement to produce 9 units of A and 7 units of B | 5 units | 7 units | 2 units |
| Requirement to produce 5 units of A and 9 units of B | 3 units | 9 units | 4 units |

Main Answer

Let's produce 9x units of A and 7y units of B from older process

Let's produce 5x units of A and 9y units of B from newer process

Objective function: Maximize: 60(9x + 5x) + 90(7y + 9y)

Subject to:

| | | |
|---|---|---|
| 9x + 5x ≥ 500<br>(Minimum production of A) | 7y + 9y ≥ 300<br>(Minimum production of B) | 5x + 3y ≤ 1,500<br>(Crude Q) |
| 7x + 9y ≤ 1,900 (Crude P) | 2x +4y ≤ 1,000 (Crude R) | x, y ≥ 0 |

**9.**

| | **Store 1** | **Store 2** | **Store 3** | **Total supplies** |
|---|---|---|---|---|
| **Plant 1** | **49** | **60** | **56** | **14** |
| **Plant 2** | **45** | **55** | **53** | **26** |
| **Plant 3** | **50** | **80** | **70** | **36** |
| **Plant 4** | **52** | **64** | **55** | **22** |
| **Total Demand** | **20** | **32** | **25** | |

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

**Answer:**

Total demand = 77. Total supplies = 98. Introduce dummy store demanding 21 with zero transportation cost.

Contribution per unit (₹)

| | Store 1 | Store 2 | Store 3 | Store 4 | Total supplies |
|---|---|---|---|---|---|
| Plant 1 | 49 | 60 | 56 | 0 | 14 |
| Plant 2 | 45 | 55 | 53 | 0 | 26 |
| Plant 3 | 50 | 80 | 70 | 0 | 36 |
| Plant 4 | 52 | 64 | 55 | 0 | 22 |
| Total Demand | 20 | 32 | 25 | 21 | 98 |

To Find the initial solution by North-west Corner method.

Opportunity Loss Matrix

| | Store 1 | Store 2 | Store 3 | Store 4 | Total supplies |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Plant 1 | 31 | 20 | 24 | 80 | 14 |
| Plant 2 | 35 | 25 | 27 | 80 | 26 |
| Plant 3 | 30 | 0 | 10 | 80 | 36 |
| Plant 4 | 28 | 16 | 25 | 80 | 22 |
| Total Demand | 20 | 32 | 25 | 21 | 98 |

| | Store 1 | Store 2 | Store 3 | Store 4 | Total supplies |
|---|---|---|---|---|---|
| Plant 1 | 14 | | | | ~~14~~ |
| Plant 2 | 6 | 20 | | | ~~26~~ |
| Plant 3 | | 12 | 24 | | ~~36~~ |
| Plant 4 | | | 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 | Store 1 | Store 1 | Store 2 | Store 2 | Store 3 | Store 3 | Store 4 |
| Units | 14 | 6 | 20 | 12 | 24 | 1 | Dummy |
| Feasibility test | m + n -1 =7 | | No. of allocations = 7 | | | The solution is feasible | |

**10. (a) Draw the network for the following activities and find critical path and total duration of project:**

| Activity | Duration (months) | Activity | Duration (months) |
|---|---|---|---|
| **1-2** | **1** | **3-6** | **1.5** |
| **2-3** | **4** | **4-7** | **3.5** |
| **2-4** | **5** | **5-7** | **2.5** |

| | | | |
|---|---|---|---|
| **3-4** | **3** | **6-7** | **1** |
| **4-5** | **1.5** | **7-8** | **4** |

**(b)**

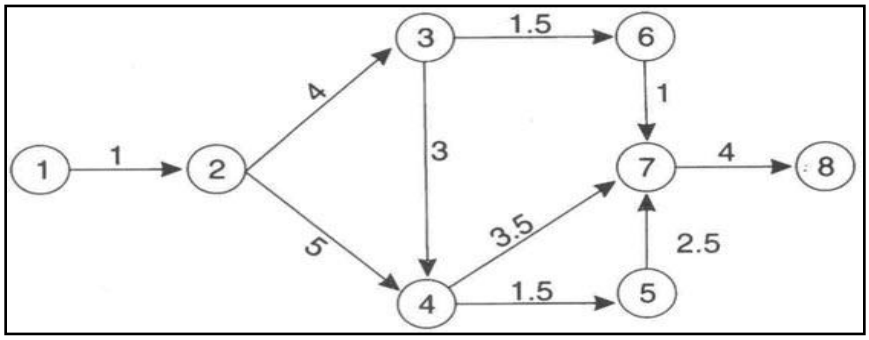
**Draw network. Determine the critical path and duration of the project. Make float analysis.**

**(Duration in days)**

| **Activity** | **0-1** | **1-2** | **1-3** | **2-4** | **2-5** | **3-4** | **3-6** | **4-7** | **5-7** | **6-7** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Duration** | **2** | **8** | **10** | **6** | **3** | **3** | **7** | **5** | **2** | **8** |

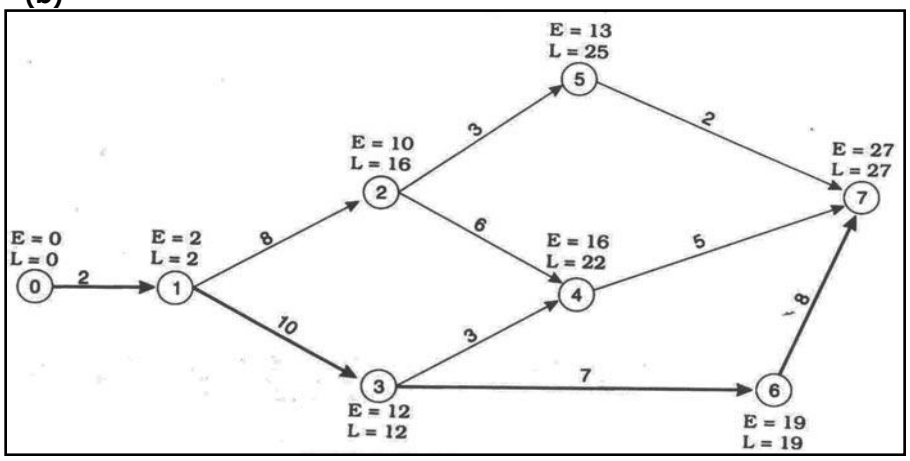
**Answer:**

**(a)**




| Paths | Duration (Months) |
|---|---|
| 1-2-3-6-7-8 | 1+4+1.5 + 1+4= 11.50 |
| 1 -2-4-5-7-8 | 1+5 + 1.5 + 2.5+4 = 14 |
| 1-2-4-7-8 | 1+5 + 3.5 + 4= 13.50 |
| 1-2-3-4-5-7-8 | 1 +3+3 + 1.5 +2.5+ 4=15 (Critical path) |
| 1-2-3-4-7-8 | 1 + 3 + 3 + 3.5 +4 = 14.50 |

**(b)**




The critical path is 0-1-3-6-7. Its duration is 27 days.

| Activity | Duration | ES | LF | EF | LS | HES | TES | TF | FF | Indepen. F |
|---|---|---|---|---|---|---|---|---|---|---|
| 0-1 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | | |
| 1-2 | 8 | 2 | 16 | 10 | 8 | 6 | 0 | 6 | 0 | 0 |
| 1-3 | 10 | 2 | 12 | 12 | 2 | 0 | 0 | 0 | 0 | 0 |
| 2-4 | 6 | 10 | 22 | 16 | 16 | 6 | 6 | 6 | 0 | 0 |
| 2-5 | 3 | 10 | 25 | 13 | 22 | 12 | 6 | 12 | 0 | 0 |
| 3-4 | 3 | 12 | 22 | 15 | 19 | 6 | 0 | 7 | 1 | 1 |
| 3-6 | 7 | 12 | 19 | 19 | 12 | 0 | 0 | 0 | 0 | 0 |
| 4-7 | 5 | 16 | 27 | 21 | 22 | 0 | 6 | 6 | 6 | 0 |
| 5-7 | 2 | 13 | 27 | 15 | 25 | 0 | 12 | 12 | 12 | 0 |
| 6-7 | 8 | 9 | 27 | 27 | 19 | 0 | 10 | 0 | 0 | 0 |

**11. (a) What are the requirements of effective Production Planning and Control System?**
**(b) Discuss the five qualitative approaches of Forecasting.**

**Answer:**

**(a)**

**Requirements of Effective Production Planning and Control System**

1. Sound organizational structure with mechanism for proper delegation of authority and fixation responsibility at all levels.
2. Information feedback system should provide reliable and up-to-date information to all

persons carrying out ppC functions.

3. Standardisation of materials, tools, equipments, labour, quality, workmanship etc.
4. Trained personnel for using the special tools, equipments and manufacturing processes.
5. Flexibility to accommodate changes and bottle-necks such as shortage of materials, power failures, machine break downs and absenteeism of employees.
6. Appropriate management policies regarding production and inventory levels, product - mix and inventory turnover.
7. Accurate assessment of manufacturing lead times and procurement lead times.
8. Plant capacity should be adequate to meet the demand. The plant should be flexible in order to respond to the introduction of new products, changes in product-mix and production rate.

**(b)**

Qualitative approaches include five forecasting techniques:

- Grass-root Forecasting
- Focused Forecasting
- Historical Analogy
- Panel Consensus
- Delphi Method

**Grass-root Forecasting:** People at the grass-root level in the organization, who are in direct contact with the phenomenon under study, are asked to give inputs in forecasting. For example, sales representatives could be asked to give information on current market conditions. These inputs are satisfactory for short- term planning.

**Focused Forecasting:** This method integrates common sense, grass-root inputs and computer simulation processes to assess the forecasts. For example, an Income-tax Inspector would forecast the earning of a store from the number of customers entering the store. He would multiply the number of customers with an expected average value of purchases made by each customer. This gives him a rough estimate of the earnings of the store.

**Historical Analogy:** Information of past events is used to give insights into prediction on related future developments. It is assumed that the future events would follow similar pattern as the of the past events. This approach gives inaccurate forecasts as the past events might not have had similar conditions as that which the future events could encounter. For example, demand for laptop computers based on the past sales of desktop computers do not give a correct forecast.

**Panel Consensus:** A group of knowledgeable persons are invited for an open discussion on a topic selected for forecasting. It is believed that a single person might not be able to consider all the aspects on the topic. Collective effort of the group invited to interact and come to a consensus on a subject, is considered as the acceptable approach for forecasting. The group could have persons from marketing, engineering, sales, materials management, etc. The basic objective of this approach is to use the creatively of the members of the group. This process is not sophisticated, and works well as the group members have a true sense of participation and bring out workable solutions.

**Delphi Method:** A number of experts associated with the subject is asked to give their response

to pre-selected questions, which would help in forecasting. The experts could be persons from within the organization or from outside the organization. For example, if the forecast is to be made on "The future use of energy in the industry", the experts panel could include persons from concerned research organization of the industry, Chamber of Commerce, Department of Energy, Industry Association, Center for Energy in Universities or management institutions, and machinery manufacturers manufacturing energy efficient equipments. The coordinator for forecasting obtains the responses from the experts, complies and analyses the responses and gives feedback to the experts involved in the process. The coordinator again formulates new questions to obtain the response from the experts again. The process of obtaining responses is repeated in few rounds until the coordinator is satisfied that a good conclusion is reached on the subject.

As the experts come from diverse backgrounds, they look at the issue independently from their own perspectives. On getting the feedback, they are able to appreciate the views of the experts from other expertise fields also. This gives them better understanding of the issue. The result of Delphi is arrived by pooling up the knowledge of various experts and brings very good results.

**12. (a) State the complexities of Economic Batch Quantity Scheduling.**
**(b) Discuss the objectives of Material Requirement Planning.**
**(c) Write a note on Flexible Manufacturing System.**

**Answer:**

**(a) Complexities of EBQ Scheduling**

1. Because of differing requirements, set-up costs and inventory carrying costs for each job, inventories resulting from EBQ lots may not last through a complete cycle. Because of stock-outs, special orders of smaller size may then be needed resulting in capacity dilution.
2. Competition for machine and/or worker time may cause scheduling interference especially when operating near capacity limits. Lots may be split in order to maintain scheduled commitments leading to reduced capacity due to increased set up time.
3. Limited capacity of a bottleneck machine or process through which all or most of the jobs must be sequenced, may exert pressure towards smaller lot sizes and causing splits ups.
4. Where parts or products are produced in regular cycles, individual lot-sizes are determined to fit in with the cycles rather than from the balance of setup and inventory carrying costs for each item.
5. The assumption of constant demand may not be met either as a result of seasonal usage or sales or because demand is dependent on production schedules of other parts, sub-assemblies or products.
6. The production lot size may not be equal to transit-lot-size, thereby making EBQ formulation invalid.

Most of the above reasons for deviating from EBQ formula lead to smaller lot sizes and to reductions in effective capacity.

The EBQ formula is used in practice as a guide for determining the length of production runs for a single inventory item. As a comprehensive batch scheduling technique it is not entirely satisfactory because of the following facts.

(a) Inventory items share common production capacity.

(b) 'Length of production run' decisions must be made simultaneously for all inventory items

to be produced in each time period.

(c) The EBQ decision should be based on most current information about demand rates and production rates and not on estimates of annual demand.

These deficiencies of the EBQ formula in planning the length of production runs have led to the development of the 'RUN-OUT' method for planning production schedules in capacity-constrained production operation when batches of product varieties are produced on common assembly lines.

**(b) Objectives of Material Requirement Planning**

**Inventory reduction:** MRP determines how many components are required, when they are required in order to meet the master schedule. It helps to procure the materials/components as and when needed and thus avoid excessive build up of inventory.

**Reduction in the manufacturing and delivery lead times:** MRP identifies materials and component quantities, timings when they are needed, availabilities and procurements and actions required to meet delivery deadlines. MRP helps to avoid delays in production and priorities production activities by putting due dates on customer job orders.

**Realistic delivery commitments:** By using MRP, production can give marketing timely information about likely delivery times to prospective customers.

**Increased efficiency:** MRP provides a close coordination among various work centres and hence helps to achieve uninterrupted flow of materials through the production line. This increases the efficiency of production system.

**(c)** A flexible manufacturing system (FMS) is a configuration of a group of production machines (or workstations) connected by automated material handling and transferring machines and integrated by computer system which can give instructions to produce hundreds of different parts in whatever order specified.

An FMS is a type of flexible automation system which builds on the programmable automation of NC and CNC machines. Materials are automatically handled and loaded and unloaded for machining operations. Programs and tooling set up can be quickly changed and production can be quickly switched on from one job to another with no loss of change over- time.

Key components of an FMS are:

(a) Several computers controlled machining centres or workstations having CNC machines and robots for loading and unloading.

(b) Computer controlled transport system (AGVs) for moving materials and parts from one machine to another and in and out of the system.

(c) Computer controlled robots for loading and unloading stations.

(d) An automated storing and retrieval system.

## Study Note — 3(Productivity Management and Total Quality Management)

**13. (a) 'Basically productivity is measured in two ways.'- Discuss.**
**(b) What is the need for Productivity Improvement?**

**Answer:**

**(a)** Basically productivity is measured in two ways.

1. **Partial Productivity:** This measures productivity of one factor or input, keeping other factors or inputs constant or unchanged. Mathematically, this is a partial derivative of the output with respect to one input, keeping the other inputs constant. Various productivity ratios can be calculated with respect to other inputs such as material, energy consumed, and so on.
2. **Total Productivity:** Here, productivity is calculated with respect to the total cost or the total finances committed, instead of one input, as given below:

$$\text{Productivity} = \frac{\text{Value Added}}{\text{Total Factor Cost}} = \frac{\text{Value of Gross Output}}{\text{Total Value of Inputs}}$$

The total factor productivity is a measure of the overall changes in production efficiency.

**(b)** Productivity improvement is vital not simply for firms but also nations, which are facing international competition. At the firm level, it is one of the most important instruments to reduce costs, improve profitability, and enhance competitive strength of the firm in the market. At the national level, it is means not to improve the nation's competitive position in the international market but also to check inflationary pressures in the economy. in fact, it is the backbone of supply-side economics. at both the micro and the macro levels, increased productivity implies economy in use of productive resources.

In business, improved productivity may lead to:

1. Better consumer service through lowering of prices;
2. Increased cash flows, improved return on assets, and greater profits;
3. Increased profits that would enhance stock price substantially;
4. Increased profits that would lead to expansion of capacity and creation of new jobs;
5. Greater investment in R/D and development of new products; and
6. Better living standards. "economists do not agree on many things, but all agree that improved living standards are dependent absolutely on increasing productivity."

**14. (a) State the advantages of KAIZEN Technique.**
**(b) 'Quality circles adoption leads to benefits Individuals and Organization.'- list the benefits.**

**Answer:**

**(a)** The KAIZEN gives freedom to the employees. it does not specify what changes are to be made or how many of them are to be made. Improvements can be in any discipline and in any field of human activity related to the productivity. These decisions are left to the individuals. This leads to obvious advantages as follows :

(i) The first and foremost benefit of KAIZEN is that it brings about attitudinal changes among employees towards improvements of their routine work. Hence it increase the productivity and a new work culture is created in the organisation.

(ii) Once the culture is transformed, the way gets cleared for introducing other productivity improvement systems like JIT, KANBAN etc. obviously leading to productivity improvement. KAIZEN system reduces resistance to change.

(iii) Ownership of work improves in KAIZEN environment. it is the inner voice of the employees that drives them to make the improvements, rather than the orders given down through the

hierarchy.

**(b) Benefits for the Individual**

**(i)Personality Development.** for doing a job, everyone needs some kind of help from others, during such help exchange of ideas are involved. this leads to the personality development of an individual as he is sure to receive good ideas of others.

**(ii)Mutual Development.** Quality circle is a group activity, as such in a group every individual, besides, developing self also help in the development of others, this leads to development of the whole group which in turn leads to the development of society and nation.

**(iii)Job Satisfaction.** It is a well-known fact that an individual or a group feels satisfied if the ideas given by them are implemented.

this is also a human tendency that once encouraged every person tries to do more and more constructive work in future. this gives job satisfaction. Moreover a stage comes when salary, allowances post, facility do not encourage an individual if his ideas are not given due importance.

**(iv)Problem Solving Capability.** in the absence of QC, every problem has to be solved by management. it is quite possible that top management may not completely understand the problems of a particular work area.
QC member are well in touch with the problems of their work area and hence can find best solution of such problems earlier.
This way the management can look into other work and problem solving capability in QC member are enhanced.

**(v)Togetherness.** QC is a group activity and this way it creates an atmosphere where an individual starts thinking about we rather than i, this reduces and eliminates the enemity between workers and then the problems can be solved easily.

**(vi)Better Human Relationship.** QC leads to better relationship because if we work together, we are sure to develop better relationship with others.

**(vii)Exchange of Good Thoughts.** When the better human relations are established we can exchange our thoughts in a better manner and without any hesitation.

**(viii)Orating Capability (Stage openings).** Many times an individual may not explain his ideas due to hesitation or shyness, after working in QC, a member can get rid off such problems and can express themselves in a better manner.

**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.

**15. (a) State the five principles of Total Quality Management.**
**(b) List the common pitfalls in Benchmarking.**
**(c) Write the success factors of Quality Function Deployment.**

**Answer:**

**(a)**

1. Concentrate on the customer

Be customer focused

2. Do it right

Do it right first time

Constantly improve

Quality is an attitude not a inspection process

3. Communication and educate

tell staff what is going on

educate and train

4. Measure and record

Measure work

5.Do it together

top managemet must be invovled

empower the staff

Make the business a good place to work

Organise by process not function

**(b)Common Pitfalls in Benchmarking**

- Lack of management commitment and involvement.
- Not applied to critical areas first
- Inadequate resources.
- No line organisation involvement.
- Too many subjects ; scope not well defined.
- Too many performance measures.
- Critical success factors and performance drivers not understood or identified.
- Potential partners ignored : Internal organisations, Industry leaders, or friendly competitors.
- Poorly designed Questionnaires,
- Inappropriate data : Inconsistent data.
- Analysis paralysis, excess precision.
- Communication of findings without recommendations for projects to close gaps.
- Management resistance to change.
- No repeat Benchmarking.
- No Benchmarking report/documentation.

**(c) Success Factors :**

- Accurate customer voice.
- Strong Management Commitment.
- A good consultant.
- A realistic time line.
- Regular project reviews.
- Milestone celebration to keep interest high and to develop a sense of closure.
- Sharing with other teams to facilitate deeper learning.

**16. The following data are available for a manufacturing unit:**

| | |
|---|---|
| **No. of operators** | **15** |
| **Daily working hours** | **8** |
| **No. of days per month** | **25** |
| **Std. Production per month** | **300 units** |
| **Std. Labour hours per unit** | **8** |
| **The following information was obtained for January 2014:** | |
| **Man days lost due to absenteeism** | **30** |
| **Unit produced** | **240** |
| **Idle Time** | **276 man hours** |

**You are required to calculate the following:**

**(i) Percent absenteeism**

**(ii) Efficiency of utilization of labour**

**(iii) Productive efficiency of labour**

**(iv) Overall productivity of labour in terms of units produced per man per month.**

**Answer:**

No. of days, per month = 25

Daily hrs. = 8

No. of operators = 15

No. of man days = 15 × 25 = 375 man days.

Total working hrs. = 375 × 8 = 3,000

Hours lost in absenteeism = 30 × 8 = 240

**(i)** Percent absenteeism = $\frac{240 \text{ hrs.} \times 100}{3{,}000 \text{hrs.}} = 8\%$

**(ii)** Efficiency of utilization of labour = $\frac{\text{Standard labour hour to produce 240 units}}{\text{Total Labour hour}}$

$= \frac{240 \times 8 \times 100}{3{,}000} = 64\%$

**(iii)** Standard time required to produce 240 units = 240 × 8 = 1920 labour- hours.

In January, man hours lost = 30 × 8 = 240

∴ idle time = 276

Total loss of time = 240 + 276 = 516 hours.

Productive hours available in January = 3,000 hrs.

Less: Total loss of time = 516 hrs.

Actual labour = 2,484 hrs.

Efficiency of labour = $\frac{\text{Std. Labour hrs.}}{\text{Actual Labour hrs.}} = \frac{1,920 \times 100}{2,484} = 77.3\%$

**(iv)** 15 men produce 300 units,

Std. labour productivity = 300/15 = 20 units.

In January, overall productivity = 240/15 =16 units i.e. productivity falls by 20%.

## Study Note — 4(Economics of Maintenance and Spare Management)

**17. (a) State the objectives of Maintenance Management.**

**(b) 'TPM is a comprehensive system of equipment maintenance that encompasses all activities with any influence on equipment up time.'- Discuss about the activities.**

**(c) Write a note on Rotable Spares.**

**Answer:**

**(a)** The following are some of the objectives of Maintenance Management:

1. Minimizing the loss of productive time because of equipment failure (i.e., minimizing idle time of equipment due to break down).
2. Minimizing the repair time and repair cost.
3. Minimizing the loss due to production stoppages.
4. Efficient use of maintenance personnel and equipments.
5. Prolonging the life of capital assets by minimizing the rate of wear and tear.
6. To keep all productive assets in good working condition.
7. To maximize efficiency and economy in production through optimum use of facilities.
8. To minimize accidents through regular inspection and repair of safety devices.
9. To minimize the total maintenance cost which includes the cost of repair, cost of preventive maintenance and inventory carrying costs due to spare parts inventory.
10. To improve the quality of products and to improve productivity.

**(b)** TPM is a comprehensive system of equipment maintenance that encompasses all activities with any influence on equipment up time (i.e., working time). These activities are :

**(i)Regulating basic conditions :** TPM advocates keeping a well organised shop floor which should be very clean.

**(ii) Adhering to proper operating procedures :** The most significant cause of failure is operators deviating from procedures and introduce errors and variance into the process.

**(iii)Restoring deterioration :** TPM requires diligent efforts to discover and predict deterioration in equipment and then follow standard repair methods to eliminate any source of variation in the system.

**(iv)Improving weaknesses in design :** TPM tries to identify and correct any defects in equipment designs that contribute to break-downs or complicate maintenance.

**(v)Improving operation and maintenance skills :** Equipment users (i.e., workers) contribute to TPM by learning and following correct operating procedures to prevent errors and correct any

problems on the first attempt. TPM enhances the skill of both users and maintenance workers through education and training.

**(c)** These are repairable and re-usable spares, such as a jet engine or an electric motor which can be reconditioned after failure and put back in operation. This situation can be visualised in a Multiple Channel Single Service Queueing theory format, where the defective equipments are the arrivals and the spares are the servers. The service times are given by the distribution of time to recondition a spare. The inter-arrival times of the defective items can also be modelled in terms of a probability distribution.

An equipment is down only when no spare is available from the spares bank. The average waiting time for this situation can be found from the queueing tables for an infinite or a finite source (as the situation may be) for a Multiple Channel Single Service queue system. These downtimes and associated costs can be calculated for various stocking policies for the spares (i.e. various assumed number of spares). The total costs of any policy are the downtime costs and the costs of stocking the spares. An illustrative example is given as follows.

**18. (a) The number of breakdowns of equipment over the past 2 years is as below:**

| No. of breakdowns | No. of month this occurred |
|---|---|
| **0** | **3** |
| **1** | **7** |
| **2** | **9** |
| **3** | **3** |
| **4** | **2** |
| **Total** | **24** |

**Each break down costs an average of ₹300. Preventive maintenance service can be hired at a cost of ₹150 per month and it will limit the breakdowns to an average of one per month. Which maintenance arrangement is preferable, the current breakdown maintenance policy or a preventive maintenance service contract?**

**Answer:**

Step 1: Calculation of probability distribution of breakdowns:

| No. of breakdowns (x) | Frequency in month f(x) | Probability of breakdown P(x) |
|---|---|---|
| 0 | 3 | 3/24=0.125 |
| 1 | 7 | 7/24=0.292 |
| 2 | 9 | 9/24=0.375 |
| 3 | 3 | 3/24=0.125 |
| 4 | 2 | 2/24=0.083 |
| Total | 24 | 1.000 |

Step 2: Calculation of expected value of breakdowns:

| Probability of breakdowns P(x) | No. of breakdowns (x) | Expected value of breakdowns x. P(x) |
|---|---|---|
| 0.125 | 0 | 0 |
| 0.292 | 1 | 0.292 |
| 0.375 | 2 | 0.750 |

| | | |
|---|---|---|
| 0.125 | 3 | 0.375 |
| 0.083 | 4 | 0.332 |
| | | 1.749 = 1.75 |

Step 3: Calculating of breakdown cost:

Expected breakdown cost = (1.75 breakdowns per month) x (cost per break-down)

= 1.75 x 300 = 525

Step 4: Cost of preventive maintenance service contract per month

= 150 +300 = 450.

Savings due to preventive maintenance service contract = 525 - 450 = 75 per month.

Since there is a saving of ₹75 per month by entering into preventive maintenance service contract, it is preferable to go for preventive maintenance service contract.

**SECTION B – Information System**

## Study Note — 5(Information System Analysis and Design)

**19. (a) Discuss the general characteristics of an information system.**

**(b) Describe the different angles through which the feasibility study of the system is to be conducted.**

**(c) State the benefits and limitations of flowchart.**

**Answer:**

**(a)** The following are the general characteristics of an Information system :

**(i)Specific objective :** The information system should have some specific objective. An Information System in highly scientific research centre will have an objective to accumulate data from different activities, display of some information instantly for controlling activities and so on. in a business environment, the objective will be sharing information from different functional areas and smooth flow of information for management decision making.

**(ii)Structured :** An information system should have a definite structure with all modules of sub-systems. The structure depends on the sub-modules, their interactions and integration requirements, operational procedure to be followed and the solution sets. the structure of the information system refers to diagrammatic representation of the system showing sub-systems, their inter-relation and the procedure to be followed to fulfill the process requirements.

**(iii)Components :** The sub-systems are the components. The sub-systems should be distinguishable among themselves but have well-defined relation among. For example, a Sales system may be sub-systems like Invoicing, Delivery Monitoring, and Sales Proceeds Collection system. The inter-link between these systems must be well defined.

**(iv)Integrated:** an information system should be designed in such a fashion that proper integration among sub-systems are taken care to establish correct linkage and generate meaningful information. An information in isolation may not be that meaningful but its usage is improved if it is integrated with information of other closely related issues. for example, sales information of a region becomes more meaningful if other information like previous period sales, sales in other regions, sales of competitive products are also combined in the information set.

**(v)Life-Cycle:** An Information system will have its own life-cycle. The duration of life-cycle varies from the system to system. An information system has the similar stages of life-cycle as

seen in any other system. Every information system will have distinctly different phases - Initial, Growth, Maturity and Decline.

**(vi)Behaviour:** a system has its own set of reaction and outcome depending on the environment. a well managed business information system behaves nicely with its users by satisfying them with correct and timely information. the design of the system plays a good role in setting its behaviour pattern.

**(vii)Self-regulatory:** An Information System which may have different sub-systems interacting with the each other in a desired fashion to be operative smoothly and in the process they regulate themselves. this is what is self-regulatory nature of the system. A payroll system involves three activities – first, maintaining attendance of employees, second, pay calculation and third pay disbursement. if the target date for pay disbursement is last date of a month, the second adjusts its start time accordingly and the first one is also regulated in such a fashion that it can provide input to the second in time.

**(b)** Different angles through which the feasibility study of the system is to be conducted:

**(i) Technical feasibility:** in this study an analyst ascertains whether the proposed system is feasible with existing or expected computer hardware and software technology. the technical issues include the following:-

- Does the proposed equipment have the technical capacity to hold the data required to use the new system?
- Can the proposed application be implemented with existing technology?
- Can the system be expanded in future?
- Are there technical guarantees of accuracy, reliability, ease of access, and data security?

**(ii) Economic Feasibility/Cost-Benefit Analysis:** it includes an evaluation of all the incremental costs and benefits expected if the proposed system is implemented. The financial and economic questions raised by analysts during the preliminary investigation for estimating the following:

- The cost of conducting a full systems investigation.
- The cost of hardware and software for the class of applications being considered.
- The benefits in the form of reduced costs .
- The cost if the proposed system is not developed

**(iii) Operational feasibility:** It is concerned with ascertaining the views of workers, employees, customers and suppliers about the use of computer facility. some of the questions which help in testing the operational feasibility of a project are stated below :

- Is there sufficient support for the system from management and from users?
- Are current business methods acceptable to users?
- Are the users been involved in planning and development of the project?
- Will individual performance be poorer after implementation than before?

**Feasibility study can also be done in some other areas :**

**(iv) Financial feasibility:** it is to be analysed that whether the cost of the proposed system is

communesrate with the size of the organization.

**(v) Schedule or time feasibility:** If new system will take long time, the organizations can go for other alternative that the company can implement in a shorter time frame.

**(vi) Resources feasibility:** this focuses on human resources and their reluctance to move to such other locations.

**(vii) Behavioral feasibility:** if the data input for the system is not readily available or collectable, then the system may not be successful.

**(viii) Legal feasibility:** a revised system should comply with all applicable federal and state statutes about financial reporting requirements, as well as the company's contractual obligations.

**(c) Benefits of Flowchart**

- **Communication:** flowcharts are better way of communicating the logic of a system and easily understandable.
- **Effective analysis:** With the help of flowchart, problem can be analyzed in more effective way.
- **Proper documentation:** Program flowcharts serve as a good program documentation.
- **Efficient Coding:** The flowcharts act as a guide during the systems analysis and program development phase.
- **Proper debugging:** The flowchart helps in debugging process.
- **Efficient Program Maintenance:** the maintenance of operating program becomes easy with the help of flowchart. It helps the programmer to put efforts more efficiently on that part.

**limitations of using flowcharts**

- **Complex logic:** Sometimes, the program logic is quite complicated. In that case, flowchart becomes complex.
- **Alterations and Modifications:** If alterations are required, the flowchart may require redrawing completely.
- **Reproduction:** As the flowchart symbols cannot be typed, reproduction of flowchart becomes a problem.

**20. (a) Discuss the various issues that should be considered while designing system input.**
**(b) Write note on the following:**
**(i) Program Debugging**
**(ii) Program Documentation**
**(iii)Operation Manuals**

**Answer:**

**(a)** Various issues that should be considered while designing systems input are briefly discussed below:

Input design consists of developing specifications and procedures for data preparation, developing steps which are necessary to put transactions data into a usable form for processing, and data-entry. Important factors to be considered in the input design :

(a) **Content:** the system designer has to prepare new documents for collecting the information which are needed to generate user output.

(b) **Timeliness:** in data processing, it is very important that data is inputted to computer in time because outputs cannot be produced until certain inputs are available.

(c) **Media:** Media is just a device by which data is entered in the system and includes magnetic tapes, magnetic disks, key-boards, optical character recognition and voice input etc.

(d) **Format:** after the data contents and media requirements are determined, input formats are to be considered. The type and length of each data field as well as any other special characteristics must be defined.

(e) **Input volume:** input volume refers to the amount of data that has to be entered in the computer system at any one time. In many real-time transaction processing systems, input volume is light. In batch-oriented transaction processing systems, input volume could be heavy which involve thousands of records and also more than it.

**(b)(i) Program debugging:** Debugging is the form of testing activity which refers to correcting programming language syntax and diagnostic errors so that the program compiles cleanly and thus in this process, errors are found and then they are corrected.

Debugging consisting of following four steps.

(a) Inputting the source program to the compiler.

(b) Letting the compiler find errors in the program.

(c) Correcting lines of code that are erroneous.

(d) Resubmitting the corrected source program as input to the compiler.

**(ii) Program documentation:** Throughout the program life cycle, documentation of procedures and instructions for the users should be made. Program documentation must include the following:

(a) A brief narrative description of what the program should do.

(b) A description of the outputs, inputs and processing to performed by the program.

(c) A deadline for finishing the program.

(d) The identity of the programming language to use and the coding standards to follow.

(e) A description of the system environment into which the program should fit.

(f) A description of the testing required to certify the program for use.

(g) A description of documentation that must be generated for users, maintenance programmers and operational personnel.

**(iii)Operation manuals :** A user's guide, also commonly known as an Operation Manual, is a document intended to give assistance to people using a particular system.

The section of an operation manual after include the following :

• A cover page, a title page and copyright page;

• A preface, containing details of related documents and information on how to navigate the user guide;

• A contents page;

• A guide on how to use at least the main functions of the system;

• A troubleshooting section detailing possible errors or problems that may occur, along with how to fix them;

• A FAQ (Frequently Asked Questions)

**21. (a) List the fact finding techniques used by the system analyst to find the needs of an organization.**

**(b) " Intregration Testing is an activity of software testing in which individual software modules are combined and tested as a group." – Discuss.**

**Answer:**

**(a)** Various fact finding techniques, which are used by the system analyst for determining the needs/requirements of an organization are discussed below:

(i) Documents: Analysts collect the hierarchy of users and manager responsibilities, job descriptions for the people who work with the current system, procedure manuals, and program codes for the applications associated with the current system to understand the existing system.

(ii) Questionnaires: Users and managers are asked to complete questionnaire about the problems with the existing system and requirement of the new system. Using questionnaires, a large amount of data can be collected very fast.

(iii) Interviews: Users and managers may also be interviewed to extract information in depth.

(iv) Observation: Observation plays a key role in requirement analysis. Only by observing how users react to prototypes of a new system, the system can be successfully developed.

**(b)** Integration testing is an activity of software testing in which individual software modules are combined and tested as a group. This is carried out in the following manner:

• **Bottom-up Integration:** It consists of unit testing, followed by sub-system testing, and then testing of the entire system. The disadvantage is that testing of major decision / control points is deferred to a later period. In this testing it starts from the bottom-up and then it tests the entire system.

• **Top-down Integration:** Once the main module testing is complete, stubs are substituted with real modules one by one, and these modules are tested. stubs are the incomplete portion of a program code that is put under a function in order to push the function .

• **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.

## Study Note — 6(Database Management System)

**22. (a) " A database has implicit properties." List the properties.**

**(b) Discuss the different categories of 'workers behind the scene' in relation to Database Management System.**

**(c) Describe the two types of data independence.**

**Answer:**

**(a)** A database has the following implicit properties:

• A database represents some aspect of the real world, sometimes called the **miniworld** or the **Universe of Discourse (UoD)**. Changes to the miniworld are reflected in the database.

- A database is a logically coherent collection of data with some inherent meaning. A random assortment of data cannot correctly be referred to as a database.
- A database is designed, built, and populated with data for a specific purpose. It has an intended group of users and some preconceived applications in which these users are interested.

**(b)** "Workers behind the scene," include the following categories.

- **DBMS system designers and implementers** are persons who design and implement the DBMs modules and interfaces as a software package. a DBMs is a complex software system that consists of many components or **modules**, including modules for implementing the catalog, query language, interface processors, data access, concurrency control, recovery, and security. the DBMs must interface with other system software, such as the operating system and compilers for various programming languages.
- **Tool developers** include persons who design and implement tools—the software packages that facilitate database system design and use, and help improve performance. tools are optional packages that are often purchased separately. they include packages for database design, performance monitoring, natural language or graphical interfaces, prototyping, simulation, and test data generation. in many cases, independent software vendors develop and market these tools.
- **Operators and maintenance personnel** are the system administration personnel who are responsible for the actual running and maintenance of the hardware and software environment for the database system.

Although the above categories of workers behind the scene are instrumental in making the database system available to end users, they typically do not use the database for their own purposes.

**(c)** We can define two types of data independence:

**1. 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. 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.

**2. 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.

**23. (a) Explain the user-friendly interfaces provided by a Database Management System.**

**(b) X and Y are two relations as shown below:**

**Relation X**

| REGN_NO | NAME | OCCUPATION |
|---|---|---|
| ABC 123 | AMAL | SERVICE |
| ABC 124 | KAMAL | STUDENT |

| | | |
|---|---|---|
| **ABC 125** | **BIMAL** | **STUDENT** |
| **ABC 129** | **RITA** | **SERVICE** |
| **ABC 130** | **SITA** | **BUSINESS** |
| **ABC 131** | **GITA** | **STUDENT** |

**Relation Y**

| REGN_NO | NAME | OCCUPATION |
|---|---|---|
| **ABC 124** | **KAMAL** | **STUDENT** |
| **ABC 125** | **BIMAL** | **STUDENT** |
| **ABC 131** | **GITA** | **STUDENT** |
| **ABC 234** | **MITA** | **STUDENT** |
| **ABC 235** | **SUMITA** | **STUDENT** |
| **ABC 236** | **SUCHITRA** | **STUDENT** |

**Find X∩Y and X-Y.**

**Answer:**

**(a)** User-friendly interfaces provided by a DBMS may include the following:

**Menu-Based Interfaces for Browsing**- these interfaces present the user with lists of options, called **menus**, that lead the user through the formulation of a request. Menus do away with the need to memorize the specific commands and syntax of a query language; rather, the query is composed step by step by picking options from a menu that is displayed by the system. pull-down menus are becoming a very popular technique in window-based user interfaces. they are often used in **browsing interfaces**, which allow a user to look through the contents of a database in an exploratory and unstructured manner.

**Forms-Based Interfaces**- a forms-based interface displays a **form** to each user. Users can fill out all of the form entries to insert new data, or they fill out only certain entries, in which case the DBMS will retrieve matching data for the remaining entries. forms are usually designed and programmed for naive users as interfaces to canned transactions. Many DBMss have **forms specification languages**, special languages that help programmers specify such forms. Some systems have utilities that define a form by letting the end user interactively construct a sample form on the screen.

**Graphical User Interfaces**- A graphical interface (GUI) typically displays a schema to the user in diagrammatic form. the user can then specify a query by manipulating the diagram. in many cases, GUIs utilize both menus and forms. Most GUIs use a **pointing device**, such as a mouse, to pick certain parts of the displayed schema diagram.

**Natural Language Interfaces**- these interfaces accept requests written in english or some other language and attempt to "understand" them. A natural language interface usually has its own "schema," which is similar to the database conceptual schema. the natural language interface refers to the words in its schema, as well as to a set of standard words, to interpret the request. if the interpretation is successful, the interface generates a high-level query corresponding to the natural language request and submits it to the DBMs for processing; otherwise, a dialogue is started with the user to clarify the request.

**Interfaces for Parametric Users**- parametric users, such as bank tellers, often have a small set of operations that they must perform repeatedly. systems analysts and programmers design and implement a special interface for a known class of naive users. Usually, a small set of abbreviated commands is included, with the goal of minimizing the number of keystrokes required for each request. for example, function keys in a terminal can be programmed to initiate the various commands. this allows the parametric user to proceed with a minimal number of keystrokes.

**Interfaces for the DBA**- Most database systems contain privileged commands that can be used only by the DBA's staff. These include commands for creating accounts, setting system parameters, granting account authorization, changing a schema, and reorganizing the storage structures of a database.

**(b)**

Relation X∩Y

| REGN_NO | NAME | OCCUPATION |
|---|---|---|
| ABC 124 | KAMAL | STUDENT |
| ABC 125 | BIMAL | STUDENT |
| ABC 131 | GITA | STUDENT |

Relation X-Y

| REGN_NO | NAME | OCCUPATION |
|---|---|---|
| ABC 123 | AMAL | SERVICE |
| ABC 129 | RITA | SERVICE |
| ABC 130 | SITA | BUSINESS |

**Chapter-7(Management Information System and Information Economics)**

**24. (a) State the objectives of Management Information System.**
**(b) Discuss the different approaches generally practiced for developing Management Information System.**
**(c) Define Executive Information System and mention its special features.**

**Answer:**

**(a)**

- To provide the managers at all levels with timely and accurate information for control of business activities
- To highlight the critical factors in the operation of the business for appropriate decision making
- To develop a systematic and regular process of communication within the organization on performance in different functional areas
- To use the tools and techniques available under the system for programmed decision making
- To provide best services to customers
- To gain competitive advantage
- To provide information support for business planning for future

**(b) Different Approaches for developing Management Information System**

**Top down Approach:** Top Down Approach starts from the identification of information requirements of different activities of the organization by the top management in order to have information support in strategic and tactical decision making and designing the information system accordingly. top Management provides the guidelines for basic objectives, policies and plan for developing these sub- systems. In other words, this approach designs a model of information flow and same model is used in developing all the sub-systems under the

Mis.

each sub-systems will have different modules and they are collectively integrated to form a sub-system. the approach of integration is same for all sub-systems. the implementation of different sub-systems is done on the basis of broad guidelines of the top management. integration of all sub-systems is done at the end to form a comprehensive Mis for the organization. the implementation process is very scientific, systematic and simple.

**Bottom Up approach:** in the Bottom Up approach, each sub-systems for different functional areas like payroll, sales Management, production Management, inventory Control system are developed according to the specifications for each sub-systems on the basis of types of input documents, flow of information and output requirements. there is no common approach for system development. rather, the sub-systems are developed purely on the basis of control information requirements for each sub- systems and guidelines generated by the manager of the respective functional areas.

The next step in the bottom up approach is to integrate the information of these sub-systems for a comprehensive MIS for the organization. This step is a complicated one in this approach.

**(c)** An Executive Information System (EIS) is special type MIS meant for top management of an organization. In other words, it is a Decision Support System (DSS) for executives. executive decisions are of three types – strategic planning, tactical planning and 'fire-fighting'.

According to CIMA

An Executive Information System (EIS) is a set of procedure designed to allow senior managers to gather and evaluate information relating to the organization and its environment.

Following are the special features of an EIS:

- it a specially designed tool to feed executives information need.
- it is an easy - to - use and screen based software.
- it provides the executives the facilities of on-line analysis tools like time series analysis, regression analysis etc.
- it is not limited to internal data only. Access to external sources of data is also provided.
- it provides the facilities to connect to internet.
- information is presented in summary format.
- it is a comprehensive information system and work in conjunction with DSS.

**25. (a) What are the issues that Business Intelligence team addresses.**
**(b) State the advantages and disadvantages of coding.**
**(c) " Reliability is the extent to which information is verifiable, representationally faithful, and neutral." – Justify.**

**Answer:**

**(a) A typical set of issues for the BI governance team is to address**

- Creating categories of projects (investment, business opportunity, strategic, mandatory, etc.)
- Defining criteria for project selection
- Determining and setting a framework for managing project risk
- Managing and leveraging project interdependencies

- Continually monitoring and adjusting the composition of the portfolio.

**(b) Coding Information**

- Information stored in a computer is often coded
- Coding categorises information and can replace long, description strings with a few letters or numbers (or both!)
- You are probably familiar with examples such as f for female and M for male
-

**Coding – Advantages**

Information is often coded because:

- it is quicker to enter into the computer
- it require less disc space to store, and less memory to process
- It can make processing easier – or possible – as there will be fewer responses
- it improves the consistency of the data as spelling mistakes are less likely
- Validation is easier to apply

**Coding – disadvantages**

Coding also has some negative effects:

- Information is coarsened by forcing it all into categories – there might not be a category that matches what you want to record – e.g. hair colour
- The same can be true of rounding numbers – the intervals or numbers of categories is called the granularity – this needs to be chosen carefully to maintain the quality of the information.

**(c)** Reliability is the extent to which information is verifiable, representationally faithful, and neutral.

Verifiability implies a consensus among different measurers. For example, the historical cost of a piece of land to be reported in the balance sheet of a company is usually highly verifiable. The cost can be traced to an exchange transaction, the purchase of the land. However, the market value o f that land is much more difficult to verify. Appraisers could differ in their assessment of market value. The term *objectivity* often is linked to verifiability. The historical cost of the land is objective but the land's market value is subjective, influenced by the measurer's past experience and prejudices. A measurement that is subjective is difficult to verify, which makes it more difficult for users to rely on.

Representational faithfulness exists when there is agreement between a measure or description and the phenomenon it purports to represent. for example, assume that the term *inventory* in a balance sheet of a retail company is understood by external users to represent items that are intended for sale in the ordinary course of business. if inventory includes, say, machines used to produce inventory, then it lacks representational faithfulness.

Reliability assumes the information being relied on is neutral with respect to parties potentially affected. in that regard, neutrality is highly related to the establishment of accounting standards. you learned earlier that changes in accounting standards can lead to adverse economic consequences to certain companies, their investors and creditors, and other interest groups. accounting standards should be established with overall societal goals and specific objectives in mind and should try not to favor particular groups or companies.

The qualities of relevance and reliability often clash. for example, a net income forecast provided by the management of a company may possess a high degree of relevance to

investors and creditors trying to predict future cash flows. However, a forecast necessarily contains subjectivity in the estimation of future events.

## Study Note — 8(Enterprise Resource Planning)

**26. (a) Explain the advantages of successful implementation of an ERP system.**
**(b) Describe the term Business Process Re-engineering(BPR).**

**Answer:**

**(a) Advantages of the successful implementation of an ERP system**

• **Business integration and Improved Data accuracy:** ERP system is composed of various modules/ sub modules where a module represents a particular business component. If data is entered in one module such as receiving, it automatically updates other related modules such as accounts payable and inventory. this updating occurs at real time i.e. at the time a transaction occurs. since, data needs to be entered only once at the origin of transaction, the need of multiple entries of the same data is eliminated. Likelihood of duplicate/ erroneous data is, therefore, minimized. The centralized structure of the data base also enable better administration and security provisions, which minimizes loss of sensitive data.

• **Planning and MIS:** The various decision support tools like planning engines and simulations functions, form integral part of an ERP system which helps in proper utilization of resources like materials, human resources and tools. Constrained based planning help in drawing appropriate production schedules, thereby improving operation of plant and equipment. As a part of MIS, an ERP system, contains many inbuilt standard reports and also a report writer which produce ad hoc reports, as and when needed.

• **Improved Efficiency and Productivity:** in addition to provision of improved planning, ERP system provides a tremendous boost to the efficiency of day to day and routine transactions such as order fulfillment, on time shipment, vendor performance, quality management, invoice reconciliation, sales realization, and cash management. Cycle time is reduced for sales to cash and procurement to pay sequences.

• **Establishment of standardized procedures:** ERP system is based on processes of international best practices, which are adopted by the organizations during implementation. Department silos are purged and maverick practices are done away with. Because of top down view available to management, chances of theft, fraud and obsolescence are minimized.

• **Flexibility and technology:** Due to globalized environment, where production units, distribution centers and corporate offices reside in different countries, organizations need multi currency, multi language and multi accounting modes, in an integrated manner. these provisions are available in most of the ERP systems, particularly in products offered by tier 1 and tier 2 vendors. ERP vendors are also quick to adopt latest technologies, from mainframe to client server to internet. Unlike a bespoke system, Upgrading to latest technology for a running ERP system is uncomplicated, involving mostly adoption of service packs and patches.

**(b)** BPR means not only change but radical change within a short period. This change is achieved by complete revamp of organizational structure, business process workflow, job description, performance measurement and adoption of information technology.

Some of Basic characteristics of BPR are:

- View business as a set of customer (both internal and external) oriented processes rather than a set of departmental functions.
- Processes must have clear cut ownership.
- Non value adding activities within a process should be eliminated.

- gather information only once at the point of origin.

A successful BPR implementation brings significant improvement to productivity, customer service and bottom-line. There are pain and difficulties during implementation and instances where BPR efforts did not achieve desired result. Notwithstanding, the risk is worth taking. Otherwise, there will be greater risk of being overtaken by competitors who develop and progress rapidly through BPR.

**27. (a) Discuss the different phases of ERP life cycle.**
**(b) Describe the important functionalities of Asset Management.**

**Answer:**

**(a)** ERP life cycles, which encompass entire 10 to 20 years of effective operating life, are often confused with ERP Implementation Life Cycle. Some of the **phases of ERP life cycle** is shown in following diagram.

1. **ERP roll out:** the initial roll out of an erp system itself consists of various phases commencing with Request for Proposal (RFP) and vendor selection and ending with go live and hand holding phase. Some important matter concerning this phase, as given below, will have direct bearing on subsequent phases of ERP lifecycle:

- Degree of matching of vanilla ERP product to current business need and extent of customization
done, particularly source code customization.
- Commitment of the vendor for future development and their financial health
- Support issues including License fees and escalation thereof.

2. **Optimization:** After the system is live and rolled out, there will be a period of turmoil. Due to lack of understanding, a lot pf confusion will prevail amongst users. There will be teething problems and some software bugs will invariably appear. With retraining, some tweaking of the system and assistance from a responsive help desk, this phase should be over within six months to one year and the system should start stabilizing.

3. **Maintenance:** This is the longest period of life cycle, when the organization starts realizing value of their investment. Users will get familiar and start owning the system. Some changes will be continuing such as new reports, different workflows, some localization on taxes etc. Maintenance will be covered by service level agreement, entailing payment of license fee to the vendor. For a complicated system, there may be a third party vendor, helping maintenance at site. the license fee, due to provision of escalation, gets escalated at regular intervals and after some years, adversely effects Total Cost of Ownership (TCO).

4. **Extending Values:** This phase overlap with the phase of maintenance. New or changed business processes necessitate minor or moderate changes in the system. there may be extensive changes under scenario such as (i) implementing a new accounting system e.g. International Finance Reporting standard (IFRS) (ii) A new regulatory requirement like Goods and Service Tax Act (GTA) (iii) Mergers and acquisitions/restructuring. (iv) Extending the system with add on products such as Customer Relationship Management and Business Intelligence (BI). Sometime the cost changes may be prohibitive, particularly for systems where a lot of customization has been done during implementation phase.

Parallel to business changes, technological changes also occur. New release and versions appear for underlying technological platforms like Operating System and Data Base. ERP vendors release patches and versions of their products at regular intervals which needed to be incorporated in the existing system. This usually involves minor or moderate efforts. But,

problem arises where many software objects were customized during implementation. Retrofitting these objects for making them compatible with later versions, may turn out to be a major migration exercise involving exorbitant cost and effort.

5. **Decaying performance:** For an enterprise, business need and technological requirement, continue to evolve. Cost, Complexity and difficulty to modify and update the existing system mount. Fixing existing system is no more viable and provides diminishing return. Alternatives are investigated and decision of reimplementation is taken.

7. **Reimplementation:** Similar to Roll Out phase as mentioned above. However, the organizations are better organized now. Initial process will be carried out more professionally. It is likely that they will adopt more of a vanilla version with minimum need of customization, so that the next cycle gives a better Return on Investment (ROI).

**(b) Asset Management -** some of the important functionalities are:

1. investment and disposal method.
2. Users' defined depreciation method.
3. Periodic revaluation of fixed assets.
4. Business and insurance information.

This module is linked to general ledger to post depreciation result as well as to accounts payable and accounts receivable for buying and disposing assets. A few important master data parameters for asset Management are:

1. Defining of a schedule of Chart of Account which is needed for linking to general ledger.
2. Depreciation method.
3. remainder value or percentage.

- **Investment and Disposal Method:** This procedure is applicable when a new asset is acquired by the organization. While payment is made through accounts payable for asset acquisition, an investment transaction is generated, and the result is posted to general ledger. the asset is registered in asset management and is linked to a depreciation method. The asset is then ready for periodic depreciation and revaluation. Similarly, when an asset is sold/discarded, a disposal transaction is created in this module which generates a sales invoice in accounts receivable and post relevant transactions in general ledger.

- **Users' Defined Depreciation Method:** This functionality provides a flexible way of maintaining depreciation cost. The system allows a depreciation method which determines how the system calculate depreciation such as by a fixed amount, by a percentage of purchase price/ book value or an amount on the basis of number of years in operation. The system also allows accounting for remainder value. the depreciation method may be applicable globally for the entire organization
or specific for one or more groups of assets.

- **Periodic revaluation of Fixed asset:** This functionality enables periodic revaluation, which is a positive correction of book value of the asset, to account for market price changes. Revaluation of asset is linked to some user defined indices which are integrated in the system. Revaluation amount is, normally, calculated by the system during fiscal year closing and result is posted as yearend transaction in general ledger.

- **Business and insurance information:** Under this functionality, additional information regarding fixed assets which are non-financial in nature, are stored in a users' defined manner. Information is stored after classifying assets under various groups and sub groups. Details of insurance policies are also maintained and are linked to fixed assets.

## Study Note — 9(Cyber Law, E-commerce)

**28. (a) State the objectives and scope of the Information Technology Act,2000.**
**(b) Define Secure System.**

**Answer:**

**(a) The objectives of the act are:**

- To grant legal recognition to transactions carried out through electronic data interchange and other means of electronic communication commonly referred to as "electronic commerce" replacing the paper-based communication;
- To give legal recognition to Digital signature for authentication of any information or matter which requires authentication under any law;
- To facilitate electronic filing of documents with Government Departments;
- To facilitate electronic data storage;
- To facilitate and give legal sanction to electronic funds transfers between banks and financial institutions;
- To give legal recognition for keeping of books of account by bankers in electronic form;
- To amend the Indian Penal Code, the Indian Evidence Act, 1872; the Banker's Book Evidence Act, 1891 and the Reserve Bank of India Act, 1934.

**Scope of the act:** this act is applicable to whole of India, unless otherwise provided in the act. it also applies to any offence or contravention there under committed outside India by any person.

Different provisions of this Act came into force on the different dates as notified by the Central Government.

The act shall not be applicable to the following:

- a negotiable instrument as defined in Section 13 of the Negotiable Instruments Act, 1881;
- a Power of Attorney as defined in Section 1A of the Powers-of-Attorney Act, 1882;
- a trust as defined in Section 3 of the Indian Trusts Act, 1882;
- a will as defined in Section (h) of Section 2 of the Indian Succession Act, 1925 including any other testamentary disposition by whatever name called;
- any contract for the sale or conveyance of immovable property or any interest in such property;
- any such class of documents or transactions as may be notified by the Central Government in the Official Gazette.

**(b)** "**Secure system**" means computer hardware, software and procedure that

- are reasonably secure from unauthorized access and misuse.
- provide a reasonable level of reliability and correct operation.
- are reasonably suited to performing the intended function and
- adhere to generally accepted security procedures.

**29. (a) List the powers of Central Government to make rules under section 87 of the Information Technology Act,2000.**

**(b) State the disadvantages of E-commerce.**
**(c) List the benefits of Electronic Data Interchange.**

**Answer:**

**(a)**

Section 87 of the Information Technology Act, 2000 confers on the Central Government the power to make rules by notifying in the Official Gazette and the Electronic gazette, in respect of certain matters, some of which are:

- Manner in which
- any information or matter may be authenticated by means of digital signature under section 5;
- electronic records shall be filed, created or issued and the method of payment;
- digital signature may be affixed under section 10;
- the adjudicating officer shall hold enquiry under section 46.
- (Electronic) form in which
- electronic records shall be filed, created or issued;
- Digital signature may be affixed under section 10;
- an application for licence may be made;
- application is made for renewal of licence under section 23;
- application for issue of a digital signature certificate may be made;
- appeal may be filed .
- Prescribing fee
- payable along with application for license;
- for renewal of a license under section 23;
- (late) payable under proviso to section 23;
- to be paid to certifying authority for issue of digital signature certificate;
- for filing an appeal.
- Prescribing salary, allowances and other conditions of service of the
- Presiding Officer under section 52;
- Officers and employees.
- Prescribing procedure
- for security, for the purpose of creating secure electronic record and secure digital signature under section 16;
- For investigation of misbehavior or incapacity of the Presiding Officer .
- Prescribing
- standards to be observed by the Controller ;
- requirements which an applicant must fulfill ;
- period of validity of license granted ;
- documents which shall accompany an application for license;
- qualification and experience which the adjudicating officer shall possess;
- any other power of the civil court;

**(b)** Following are main disadvantages of e-commerce:

- **Few people are using E-commerce:** Because of technology phobia entrust only few people are using this mode of commerce. therefore, one important disadvantage of e-commerce is that the internet has still not touched the lives of a great number of people, either due to the lack of knowledge or trust. A large number of people do not use the Internet for any kind of financial transaction. some people simply refuse to trust the authenticity of completely impersonal business transactions, as in the case of e-commerce. Many people do not want to disclose personal and private information for security reasons therefore, may not fulfilling the requirement of E-commerce. further, many times, the legitimacy and authenticity of different e-commerce sites have also been questioned.

- **Unable to personally examine the product:** Buying products through the internet do not allow physical examination of products. Only images of the products may be available for viewing,but there is a risk involved in the uncertainty of the quality of the product that the consumer is purchasing.

- **Special hardware and software:** There are specific hardware and software that are essential to start an e-commerce company, which are bulky and costly.

- **Maintenance of website:** Website must be maintained and updated regularly which leads to extra labour costs.

- **Training and maintenance:** it is important to have well skilled and trained workers to create and maintain e-commerce facilities of a company.

- **Security:** an e-commerce business exposes itself to security risks and may be susceptible to destruction and disclosure of confidential data, data transfer, and transaction risks (as in online payments) or virus attacks. possibilities of stealing credit card numbers are the real threats in e-commerce activity.

- **Not suitable for perishable commodities:** another limitation of e-commerce is that it is not suitable for perishable commodities like food items. people prefer to shop in the conventional way than to use e-commerce for purchasing food products. so e-commerce is not suitable for such business sectors.

- **Delivery time:** The time period required for delivering physical products can also be quite significant in case of E-commerce. A lot of phone calls and E-mails may be required till you get your desired products.

- **Returning the product and getting a refund:** where consumer is not satisfied with a particular product then returning the product and getting a refund can be even more troublesome and time consuming than purchasing.

- **Problems of E-record:** Last but not the least, main problem in e-commerce is problems of electronic record or message when transmitted during e-transaction i.e. integrity, authentication, confidentiality and privacy.

**(c)** EDI has following benefits:

1.The use of EDI eliminated many problems associated with traditional information flow such as the delay associated with making of documents.

2. As data is not repeatedly keyed (typed) therefore the chances of error are reduced.

3. Time required to re-enter data is saved.

4. As data is not re-entered at each step in the process, therefore labour costs are reduced.

5. As time delays are reduced therefore more certainty in information flow is there.

6. EDI generates functional acknowledgement that the EDI message has been received by the recipient and is electronically transferred to sender. therefore this acknowledgement which is sent electronically by the recipient to sender, states that the message has been received.

**30. (a) Define Electronic Financial Transaction.**

**(b) "There are several kinds of legal problems or disputes in E-Commerce specially in B2C Model covered under Law of Contract." Discuss.**

**Answer:**

**(a) Electronic Financial Transaction (EFT)** refers to a process by which money is transferred from one person's bank account to another person's account electronically rather than using a cheque or transferring cash. Of course, these electronic transfers are also available to governments and businesses.

The individuals or governments or businesses using them authorize these electronic transactions in writing. the transactions are processed through the automated Clearing House (ACH) network. Organizations using the network have formed an association, national automated Clearing house association.

**(b)** There are several kinds of legal problems or disputes in E-Commerce specially in B2C Model covered under Law of Contract such as:

- the e-merchant delivers, but the customer does not admit that he or she ever received the merchandise.
- the e-merchant delivers, but the customer refuses to pay. His or her 14-year old ordered the product using a parent's Visa card without authorization. The customer pays for the goods and the e-merchant fails to deliver.
- the customer pays in full, but receives either the wrong merchandise or a partial order.
- the customer does not like the goods, but the e-merchant has no procedure for accepting returned goods.
- the customer does not like the goods but the e-merchant refuses to accept returned goods or give credit to settle the dispute.
- the customer receives the goods, but it arrives damaged. The carrier denies responsibility, the e-merchant claims it is the carrier's responsibility, and the vendor is located overseas.
- the customer receives the goods but it does not operate properly. The e-merchant asks the customer to ship the product to the manufacturer at the customer's expense. The manufacturer has no in-house service center.