Paper 9 - Operations Management and Information Systems

Section –A

[Question no. 1 is Compulsory and any 4 from the rest]

1. Answer the following questions: [6 × 2]

(a) The time study of a machinery operation recorded cycle times of 9.0, 8.0, 7.0 and 8.0 minutes. The analyst rated the observed worker as 90%. The firm uses a 0.12 allowance fraction, compute the standard time.
(b) What is Process Flexibility?
(c) Define Qualified Worker.
(d) What are the two directions of vertical integration?
(e) What are the salient points of the Activity-On –Node convention?
(f) What is Predictive Maintenance?

Answer:

1. (a) Average Cycle time = $\frac{9.0+8.0+7.0+8.0}{4}$ = 8.0 minutes.

Normal time = 8.0 × 0.9 =7.2 minutes.

Standard time = $\frac{7.2}{(1-0.12)}$ = 8.18 minutes.

The standard time for this machinery operation would be set at 8.18 minutes, which is greater than the average cycle time observed.

(b) Process flexibility refers to the degree to which the system can be adjusted to changes in processing requirements due to such factors as changes in product or service design, changes in volume of products produced and changes in technology.

(c) "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" – definition by International Labour Organization.

(d) Two directions of vertical integration are:
(i) Backward integration which represents moving upstream towards the sources of raw materials and parts, for example a steel plant 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.
(ii) Forward integration in which the firm acquires the channel of distribution (such as having its own warehouses and retail outlets).

(e) Salient points of the Activity-On Node convention are:
- Each activity is represented by a node in the network.
- A precedence relationship between two activities is represented by an arc or link between the two.
- Node is represented by a circle and indicates an Event, a point of time where one or more activities start and/or finish.

(f) One of the newer types of maintenance that may be anticipated to gain increasing attention is called predictive maintenance. In this, sensitive instruments (e.g. vibration analysers, amplitude meters, audio gauge, optical tooling, pressure, temperature and resistance gauges) are used to predict trouble. Conditions can be measured periodically or on a continuous basis and this enables the maintenance people to plan for overhaul. This will allow an extension to the service life without fear of failure.

2. (a) Machines X and Y are both capable of manufacturing a product. They compare as follows:

Particulars	Machine X	Machine Y
Investment	**₹ 1,00,000**	**₹ 1,60,000**
Interest on capital invested	**15% per annum**	**15% per annum**
Hourly charges (wages + power)	**₹ 10**	**₹ 8**
No. of pieces produced per hour	**5**	**8**
Annual operating hours	**2000**	**2000**

(i) Which machine will have the lower cost per unit of output, if run for the whole year?

(ii) If only 4000 pieces are to be produced in a year, which machine would have the lower cost per piece? [4+4]

(b) State the benefits of Work Study. [4]

Answer:

2. (a) (i)

Data	Machine X	Machine Y
Annual interest charges	₹ 1,00,000 ×(15/100) = ₹ 15,000	₹ 1,60,000×(15/100) = ₹ 24,000
Annual operating charges	₹ 10×2,000 = ₹ 20,000	₹ 8×2,000=₹ 16,000
Total annual charges	15,000+20,000 = ₹ 35,000	24,000+16,000=₹ 40,000
Annual production (units) for 2,000 hours	5×2,000 =10,000 nos.	8× 2000=16,000 nos.
Cost per unit	= ₹ 3.50	₹ 2.50

Machine 'Y' gives the lower cost per unit if run for the whole year (for 2000 hours).

(ii)

Data	Machine X	Machine Y
Operating hours required for producing 4000 nos	4000/5 = 800 hrs	4000/8 = 500 hrs
Operating charges	₹ 10 x 800 = ₹ 8,000	₹ 8 x 500 = ₹ 4,000
Interest charges	₹ 15,000	₹ 24,000
Total annual charges	8000 + 15,000 = ₹ 23,000	4000 + 24,000 = ₹ 28,000
Cost per unit	= ₹ 5.75	= ₹ 7.00

Machine 'X' gives lower cost per unit.

(b) Benefits of Work Study
(i) Increased productivity and operational efficiency.
(ii) Reduced manufacturing costs.
(iii) Improved work place layout.
(iv) Better manpower planning and capacity planning
(v) Fair wages to employees
(vi) Better working conditions to employees.
(vii) Improved work flow.
(viii) Reduced material handling costs.
(ix) Provides a standard of performance to measure labour efficiency.
(x) Better industrial relations and employee morale.
(xi) Basis for sound incentive scheme.
(xii) Provides better job satisfaction to employees.

3. (a) ORTIS INVESTMENT MANAGEMENT LTD. (a Mutual Fund company) has ₹ 40 lakh available for investment in Government Bonds, Blue Chip Stocks, Speculative Stocks and Short Term Deposits. The annual expected return and risk factor are given below:

Type of investment	Annual Expected	Risk Factor
Return (%)	**(0 to 100)**	
Government bonds	**12**	**12**
Blue chip Stocks	**20**	**24**
Speculative Stocks	**25**	**50**
Short terms Deposits	**8**	**5**

The Company (OIML) is required to keep at least ₹ 5 lakh in short term deposits and not to exceed average risk factor of 40. Speculative stocks must be at most 25% of the total amount invested.

Required:
How should ORTIS INVESTMENT MANAGEMENT LTD. invest the funds so as to maximize its total expected Annual Return?
Formulate this as a Linear Programming Problem. You are not required to solve the L.P.P. **[10]**

(b) Explain the need for acceptance sampling. **[2]**

Answer:

3. (a) Let the amount invested in the securities be as follows –
Government Bonds = X1
Blue Chip Security = X2
Speculative Stocks = X3
Short Term Deposits = X4
These investments are subject to the following conditions –
Condition – 1:
Total Investment cannot exceed ₹ 40 lakhs
$X1 + X2 + X3 + X4 \leq 40$ lakhs
Condition – 2:
Total investment in short term deposits is ₹ 5 lakhs
$X4 \leq 5$ lakhs
Condition – 3:
Average risk factor should not exceed 40

i.e., $\frac{0.12 \times 1 + 0.24 \times 2 + 0.50 \times 3 + 0.05 \times 4}{4} \leq 40$

Condition – 4:

Investment in speculative stock shall not exceed 25% of total amount invested

i.e., X3 ≤ 25% X (X1 + X2 + X3 + X4)

The objective function here is to maximize the profit –

i.e., Z max = 0.12 x 1 + 0.20 x 2 + 0.25 x 3 + 0.08 x 4

(b) Acceptance Sampling can be described as the post-mortem of the quality of the product that has already been produced. Under this technique, a sample is selected at random to examine whether it conforms to the standards laid down. This technique has all the limitations of sampling technique.

4. (a) Location S would result in annual fixed costs of ₹ 3,00,000 variable costs of ₹ 63 per unit and revenues ₹ 68 per unit. Annual fixed costs at Location T are ₹ 8,00,000, variable costs are ₹32 per unit and revenues ₹68 per unit. Sales volume is estimated to be 25,000 units/year. Calculate BEP for each location and determine which location will be attractive. [5]

(b) What is Quality Control? Mention six objectives of Quality Control. [1+6]

Answer:

4. (a) Location S: BEP (units) = $\frac{3,00,000}{68-63}$ = 60,000 and Location T: BEP (units) = $\frac{8,00,000}{68-32}$ = 22,222.

At the expected demand of 25,000 units, profits (loss) for the alternatives are:

	Location S	Location T
Revenue	17,00,000	17,00,000
Costs:		
Variables	15,75,000	8,00,000
Fixed	3,00,000	8,00,000
Total Costs	18,75,000	16,00,000
	(1,75,000)	1,00,000

Location T is more attractive, even though annual fixed costs are much higher than Location S.

(b) Quality control is a process by which entities review the quality of all factors involved in production. It is a process through which a business seeks to ensure that product quality is maintained or improved and manufacturing errors are reduced or eliminated.

The following are the main objective of quality control progaramme.

(i) To assess the quality of the raw materials, semi-finished goods and finished products at various stages of production process.

(ii) To see whether the product conforms to the predetermined standards and specifications and whether it satisfies the needs of the customers.

(iii) To reduce the wastage of raw materials, men and machine during the process of production.

(iv) To assess the various techniques of quality control, methods and processes of production and suggest improvement in them to be more effective.

(v) If the quality of the products deviates from the specifications, it is required to locate the reason for deviations and to take necessary remedial steps so that the deviation should not be recurred.

(vi) To suggest suitable improvements in the quality or standard of goods produced without much increase or no increase in the cost of production. New techniques in machines and methods may be applied for this purpose.

5. A company trading in motor vehicles spares wishes to determine the level of stock it should carry for the item in its range. Demand is not certain and replenishment of stock takes 3 days. For one item X, the following information is obtained:

Demand (Units/day)	**1**	**2**	**3**	**4**	**5**
Probability	**0.10**	**0.20**	**0.30**	**0.30**	**0.10**

Each time an order is placed, the company incurs an ordering cost of ₹ 20 per order. The company also incurs carrying cost of ₹ 2.50 per unit per day. The inventory carrying cost is calculated on the basis of average stock.

The manager of the company wishes to compare two options for his inventory decision:

A. Order 12 units when the inventory at the beginning of the day plus order outstanding is less than 12 units.

B. Order 10 units when the inventory at the beginning of the day plus order outstanding is less than 10 units.

Currently (on the first day) the company has a stock of 17 units. The sequence of random number to be used is 08, 91, 25, 18, 40, 27, 85, 75, 32, and 52. You are required to carry out a simulation run over a period 10 days, recommended which option the manager should choose. [12]

Answer:

5.

Probability distribution

Demand	Probability	Cum. Prob.	Range	Range for simulation
1	0.10	0.10	0 – 0.10	0 – 0.09
2	0.20	0.30	0.10 – 0.30	0.10 – 0.29
3	0.30	0.60	0.30 – 0.60	0.30 – 0.59
4	0.30	0.90	0.60 – 0.90	0.60 – 0.89
5	0.10	1.00	0.90 – 1.00	0.90 – 0.99

Order 12 units

Day	Opening Stock	Receipt	Demand	Closing Stock	Order placed	Average stock
1	17	-	1	16	-	16.50
2	16	-	5	11	-	13.50
3	11	-	2	9	12 units	10.00
4	9	-	2	7	-	8.00
5	7	-	3	4	-	5.50
6	4	12	2	14	-	9.00
7	14	-	4	10	-	12.00
8	10	-	4	6	12 units	8.00
9	6	-	3	3	-	4.50
10	3	-	3	0	-	1.50
Total						88.50

Carrying cost: 88.50 × 2.50 = ₹ 221.25	Ordering cost: ₹ 40	Total cost: ₹ 261.25

Order 10 units

Day	Opening Stock	Receipt	Demand	Closing Stock	Order placed	Average stock
1	17	-	1	16	-	16.50
2	16	-	5	11	-	13.50
3	11	-	2	9	-	10.00
4	9	-	2	7	10 units	8.00
5	7	-	3	4	-	5.50
6	4	-	2	2	-	3.00
7	2	10	4	8	-	5.00
8	8	-	4	4	10 units	6.00
9	4	-	3	1		2.50
10	1	-	3	Shortage of 2 units	-	0.50
Total						70.50

Carrying cost: 70.50 × 2.50 = ₹ 176.25	Ordering cost: ₹ 40	Total cost: ₹ 216.25

If shortage is a serious matter for the company, the first option is recommended; otherwise the second option is recommended.

6. (a) Write short note on Systematic Layout Planning. [6]
(b) "JIT manufacturing includes many activities." Briefly discuss the activities. [6]

Answer:

6. (a) Systematic layout planning (SLP) method is used in some production systems such as service systems, where the amount of material that flows between departments may not be critical for developing a good facility layout. This method develops a chart known as "relationship chart" or Richard Muther's half-matrix, which rates the relative importance of locating one department close to another department. The importance ratings are indicated by code letters a, e, i, o, u, x is known as 'nearness codes', which indicate the following degree of importance.

Nearness code	Degree Importance
a	absolute necessary
e	very important or essential
i	important
o	ok, ordinary importance
u	unimportant
x	undesirable

In addition to the nearness code, a reason code indicated by a number (say 1, 2 or 3) based on a variety of reasons for locating any two departments adjacent to each other, is used.

The examples of reason codes are:

Nearness code	Degree Importance
1	use of common personnel
2	noise isolation
3	safety purpose
4	ease of supervision
5	common equipment
6	type of customer

(b) JIT manufacturing includes many activities:

(i) **Inventory reduction:** JIT is a system for reducing inventory levels at all stages of production viz. raw materials, work-in-progress and finished goods.

(ii) **Quality improvement:** JIT provides a procedure for improving quality both within the firm and outside the firm.

(iii) **Lead time reduction:** With JIT, lead time components such as set-up and move times are significantly reduced.

(iv) **Vendor control/Performance improvement:** JIT gives the buying organisation greater power in buyer-supplier relationship. The firm moves from a situation where multiple suppliers are used to a situation where only one or two suppliers are used for supplying most parts. With fewer suppliers; the buying organisation has more power because it is making larger purchases from each vendor. Also, the buying organisation can now impose higher requirements on each supplier in terms of delivery and quality.

(v) **Continuous Improvement:** In the JIT system, existing problems are corrected and new problems identified in a never-ending: approach to operations management.

(vi) **Total Preventive Maintenance:** JIT emphasises preventive maintenance to reduce the risk of equipment break-downs which may cause production hold ups and increase in manufacturing cycle time due to delays.

(vii) **Strategic Gain:** JIT provides the firm's management with a means of developing, implementing and maintaining a sustainable competitive advantage in the market place.

Section – B

Question No. 7 is compulsory and any 4 from the rest

7. (a) Define Bus
(b) Need for EBCDIC Code
(c) Define Extranet
(d) Define Biometric Security **[4 × 2]**

Answer:

7. (a) All the microprocessors use bus type of design to transfer bits within the CPU, memory and input/output devices. The electrical path or channels that transfer these bits are known as buses.

(b) The abbreviation 'EBCDIC' stands for 'Extended Binary Coded Decimal Interchange Code'.
In a 6 bit BCD code, only 64 variations are possible, which are still inadequate to distinguish between lower case letters. In order to overcome this deficiency, 2 more zone bits were added to the 6 bit BCD code to give birth to what is known as EBCDIC. This code is used for storing numbers as well as characters in binary form.

(c) An Extranet is a private network to securely share part of business information or operations with suppliers, vendors, partners, customers or other businesses. It uses the internet protocol and the public telecommunication system.

(d) Biometric refers to the identification of humans by their characteristics. Biometric security is extremely secure where an individual's unique body feature such as voice, retina, and fingerprint activate these locks. A special hardware and software for image processing is needed for Authentication with the help of biometric characteristics.

8. (a) Briefly describe any four program design tools. **[6]**
(b) What are the advantages of Sequential File Organisation? **[2]**

Answer:

8. (a) (i) **Program Flow Chart:** Program Flow Chart is among the most common program design tool that managers and users encounter when reviewing the design work of the system development project. These flow chart depict the logical steps through which a computer program must proceed when solving a problem. At one time, program flow charts were considered the premier program design tool. Although they are still widely used, sometimes it is difficult for programmers to translate a program flow chat directly into a structured code. A program flow chart depicts the logical processing steps followed by a program quite well.

(ii) **Pseudo code**: When reviewing the work done by a program designer, users may also need to review narrative descriptions of program logic. Pseudo code, like program flow charts, also represents program logic. However, instead of using graphical symbols and flow lines, pseudo code presents program logic in English-like statements. Pseudo code is generally preferred by programmers over flowcharts because it represents program code more closely. Many users also find pseudo code more understandable than program flow charts.

(iii) **Structure chart:** Another type of program design tool that a user may review is the program structure chart. Structure charts, which look similar to corporate organization charts, are useful for organizing problems. The structure chart organizes each of the program tasks into well-defined modules. The higher- level modules represent control portions of the program; the lowest level modules do the actual task of the program.

(iv) **4GL Tools:** Fourth-generation languages provide a way out to remove these obstacles by automating many of the manual tasks by using 4GL tools. These tools ensure that the work done with them is consistent with the other work performed by the system team. The automation of manual task and internal consistency checks are two reasons due to which productivity gains result from using 4GL tools.

(b) Advantages of Sequential File Organization:
(i) Simple to understand the approach
(ii) Only record key required to locate record
(iii) Efficient and economical if the activity rate is high i.e. proportion of file records processing.
(iv) Inexpensive input/output devices may be used.
(v) Reconstruction of files relatively easy since a built-in backup is usually available.

9. (a) What are the different categories of tests that a programmer typically performs on a program unit? [5]
(b) Write down the characteristics of usefulness of information. [3]

Answer:

9. (a) A unit is the smallest testable part of an application which may be an individual program, function, procedure, etc. The goal of unit testing is that the individual parts are correct.
There are five categories of tests that a programmer typically performs on a program unit:
- **Functional tests**: As per this plan programmer checks by inputting the values to see whether the actual result and expected result match. The test plan tests the operating conditions.
- **Performance tests:** Performance tests should be designed to verify the response time, the execution time, and the throughput in providing the requirements made by users.
- **Stress tests**: It involves testing beyond normal operational capacity in order to observe the results. These tests are designed to overload a program in various ways. The purpose of a stress test is to determine the limitations of the program.
- **Structural tests**: Structural tests are concerned with examining the internal processing logic of a software system, whether the processing is correctly made as per the logic given.
- **Parallel tests:** In parallel tests, the same test data is used in the new and old system and the output results are then compared.

(b) The following are the main characteristics of information
- **Timeliness** - This parameter is important to increase effectiveness in the use.
- **Accuracy** – The most important ingredient for quality of information.
- **Comprehensive** – Information should be integrated one with all other related issues to make it more meaningful.

- **Relevance** – The need for type of information differs from user to user. Relevant information filtered for a purpose ensures its effective and best use.
- **Understandability** – The information must be presented in a form that users can interpret the same for decision making.

10. (a) Write a short note on Data Dictionary. [4]
(b) Discuss the different types of implementation strategies. [4]

Answer:

10. (a) **Data Dictionary**: Each computer record of a data dictionary contains information about a single data item used in a business information system. The information in each record of a Data Dictionary may include the following:
(i) Codes describing the data item's length, data type and range.
(ii) Identity of the source documents used to create the data.
(iii) Names of the computer files storing the data item.
(iv) Identity of individuals/programs permitted to access the data item.
(v) Identity of programs/individuals not permitted to access the data item.
(vi) Names of the computer programs that modify the data item.

For an Auditor, A data dictionary can also help to establish an audit trial because it can identify the input sources of data items, the computer programs that modify particular data items, and the managerial reports on which data items are output. For the accountants, a data dictionary can also be used to plan the flow of transaction data through the system.

(b) Four types of implementation strategies are as follows:
(i) Direct Implementation / Abrupt change-over: Conversion by direct change over means that on a specified date the old system is dropped and the new system is put into use. The users have no possibility of using the old system other than the new one. Adaptation is a necessity. The disadvantage is that as the old system is dropped and new system is put to use, there is no adequate way to compare new results with old ones.
(ii) Phased implementation: If each phase is successful then the next phase is started, eventually leading to the final phase when the new system fully replaces the old one. The advantage is that. It allows users to get involved with the system gradually. The disadvantage is that It takes too long to get the new system in place.
(iii) Pilot implementation: With this strategy, the new system replaces the old one in one operation but only on a small scale, it might be tried out in one branch of the company or in one location. When one operation is successfully completed, other conversions are done for other operations. Each module is thoroughly tested before being used. Users become familiar with each module as it becomes operational.
(iv) Parallel running implementation : The old system remains fully operational while the new systems come online, the old and the new system are both used alongside each other .If all goes well, the old system is stopped and new system carries on. The advantage is that there is a possibility of checking new data against old data in order to catch any errors in the processing of the new system. The disadvantage is that Cost of running two systems at the same time is high. The workload of employees during conversion is almost doubled.

11. (a) Discuss in brief Master Data Management of an ERP System. [2]
(b) What does configuration of an ERP system deals with? [2]

(c) One of the important factors for the success for MIS is the quality of software. List out the criteria, which the software must fulfill for the basis of selection apart from meeting the user specific functional specifications? [2]

(d) Write short note on Business Information System. [2]

Answer:

11. (a) ERP packages contain several modules, such as finance, sales and distribution, materials management, manufacturing and production control, human resources, plant maintenance and quality management. Main characteristic of ERP system is that all its modules function in an integrated manner. Due to integrated nature of functioning, a few master tables are referenced frequently all across the system and databases, and shared by different applications, functional areas and sites. Data incorporated thereon need to be accurate, complete, timely and consistent. The quality of data as inputted in master tables, is a major reason for success or otherwise of an ERP system.

(b) Configuration of an ERP system deals with handling of numerous usage controls, which can be switched off or switched on, so as to balance its functionalities to extant needs. First thing to happen is to install specific modules needed and configuring these modules, as per the scope of the project. Thousands of configuration tables are present, which define how the system should operate, how the data entry screen will look like, how the signals and messages will appear etc.

(c) (i) Compatibility of hardware
(ii) Capable of taking load of data volume
(iii) Have the support of software for required database
(iv) Capable of supporting the communication network
(v) Satisfy the design specifications of system architecture- central or distributed data processing.

(d) Components of Business Information System are:
(i) Transaction Processing System
(ii) Management Information System
(iii) Expert System
(iv) Decision Support System
(v) Executive Information System

12. (a) Write down the objectives of The Information Technology Act, 2000. [4]

(b) What does Section 72 of The Information Technology Amendment Act 2008 deals with? [2]

(c) Define Electronic Financial Transaction (EFT). [2]

Answer:

12. (a) The objectives of the Information Technology Act, 2000 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 fund 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.

(b) Section 72 of The Information Technology Amendment Act 2008 deals with breach of confidentiality and privacy. Securing access to any e-record, book, register, correspondence, information, document or other material and disclosing them without consent of concerned owner is punishable with imprisonment for a term upto two years or fine upto one lakh rupees or both.

(c) 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.