

**Paper 9- OPERATIONS MANAGEMENT & INFORMATION
SYSTEMS**

Paper 9 – OPERATIONS MANAGEMENT & INFORMATION SYSTEMS

Full Marks:100

Time allowed: 3 hours

Section A

I. Answer the following question which is compulsory:

1. Answer any five of the following questions: [5×2=10]

- (a) What is demonstrated capacity?
- (b) Define critical path.
- (c) Define Quality Circle.
- (d) What is P-D-C-A Cycle?
- (e) Define entropy.
- (f) What do you mean by DSS?
- (g) What is iconic scale model?

Answer:

(a) Demonstrated Capacity

The actual level of output for a process over a period of time is known as demonstrated capacity. Demonstrated Capacity deals with the actual production over a time rather than the calculated designed capacity or planned capacity. Demonstrated Capacity is determined by averaging the recorded figures of actual output over a period of time.

(b) A critical path is a chain of sequential activities beginning with the project start and ending with its completion. So, the path through the network that has the longest expected completion time and is expected to determine the completion date of the project is called the critical path.

(c) Quality Circle is a group of employees who meet regularly to consider ways of resolving problems and improving production in their organization.

(d) Deming Wheel / Deming Cycle / P-D-C-A Cycle:

- a. P – Plan (Process) the improvement;
- b. D – Do implement the plan;
- c. C – Check – check how closely result meets goals;
- d. A – Act – use the improved process as standard practice.

(e) Entropy is the quantitative measure of disorder in a system entropy requires inputs of Energy to repay replenish and maintain the system. This maintenance input is termed as negative Entropy open systems require more negative entropy than relatively closed systems for keeping at a steady state.

(f) A **decision support system (DSS)** is a computerized information **system** used to **support decision**-making in an organization or a business. A **DSS** lets users sift through and analyze massive reams of data and compile information that **can** be used to solve problems and make better decisions.

(g) It is physical replica of the system based on different scale from original, iconic models may appear to sale in three dimensions – such as model of a production process, building, car or an aircraft.

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2. Match the following:

[5×1=5]

	List A		List B
A.	Load Control	1)	Product Mix determination
B.	Linear Programming (LP)	2)	Transportation Application
C.	Vogel's Approximation Method (VAM)	3)	Bottleneck Center
D.	Information	4)	Digital Signature
E.	Primary Key	5)	Refined data

Answer:

- A. — 3)
- B. — 1)
- C. — 2)
- D. — 5)
- E. — 4)

3. Statement whether the following statements are True/False:

[5×1=5]

- (a) An operating system is defined as a configuration of resources for the provision of goods or services.
- (b) Critical path is the shortest path from beginning of the project to ending of the project.
- (c) An open system is a self contained one and normally a rigid one.
- (d) MRP is a marketing technique.
- (e) Industrial Engineering is a staff function.

Answer:

- (a) True;
- (b) False;
- (c) False;
- (d) False;
- (e) False.

4. Fill in the blanks with one word or two:

[5×1=5]

- (a) _____ are the largest ERP solution provider.
- (b) Processed data is known as _____.
- (c) Database management is responsibility of _____.
- (d) _____ is a single purpose machine tools designed for cutting gears.
- (e) Expand OLTP _____ .

Answer:

- (a) SAP;
- (b) Information;
- (c) DBA;
- (d) Hobbing machine;
- (e) On – Line Transaction Processing.

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Section – B

II. Answer any three questions from the following:

[15×3=45]

- 1. (a) The work-study engineer carries out the work sampling study for 120 hours. The following observations were made for a machine shop:**

Total number of observations	7000
No. of Idle activities	1200
Ratio between manual to machine elements	3:1
Total number of jobs produced during study	800 units
Rest and personal allowances	17%

Compute the standard time for the job.

[7]

- (b) A fleet owner finds from his past records that the costs per year of running a vehicle whose purchase price is ₹50,000 are as under:**

Year	1	2	3	4	5	6	7
Running Cost (₹)	5,000	6,000	7,000	9,000	11,500	16,000	18,000
Resale Value (₹)	30,000	15,000	7,500	3,750	2,000	2,000	2,000

Thereafter, running cost increases by ₹2,000, but resale value remains constant at ₹2,000. At what age is a replacement due?

[8]

Answer:

- (a) (1) Overall time per unit (To) = (Duration of study /Number of jobs produced during study) = $(120 \times 60) / 800 = 9\text{min}$.**

(2) Effective time per piece (Te) = TO x (Production observation / Total observation) = 9 x $(5800 / 7000) = 7.46\text{ min}$.

The effective time is to be segregated into manual time and machine element time.

Machine controlled time per piece (Tm) = $7.46 \times 1/4 = 1.87\text{ min}$

Hand controlled time per piece (Th) = $7.46 \times 3/4 = 5.59\text{ min}$

Normal time per piece = Tm + Th x Performance rating = $1.87 + 5.59 \times 1.2 = 8.58\text{ min}$.

Standard time per piece = $8.58 (1 + 0.17) = 10.04\text{ minutes}$.

- (b) State showing the Replacement Period**

Year (1)	Net Capital (₹) (2)	Annual Maintenance Cost (₹) (3)	Cumulative Operations Costs (₹) (4)	Total Cost (₹) (5 = 3+4)	Averaged Annual Cost (₹) (5) / (1)
1	20,000	5,000	5,000	25,000	25,000
2	35,000	6,000	11,000	46,000	23,000
3	42,500	7,000	18,000	60,500	20,167
4	46,250	9,000	27,000	73,250	18,313
5	48,000	11,500	38,500	86,500	17,300
6	48,000	16,000	54,500	1,02,500	17,083*
7	48,000	18,000	72,500	1,20,500	17,214

Optimal replacement at the end of 6th year.

- 2. (a) Production Manager of a unit wants to know from what quantity he can use automatic machine against semi-automatic machine.**

Data	Automatic	Semi-automatic
Time for the job	4 mins	10 mins
Set up time	4 hrs	3 hrs
Cost per hour	₹40	₹24

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Calculate the break-even point.

[5]

(b) A bakery keeps stock of a popular brand of cakes. Previous experience shows the daily demand pattern for the item with associated probabilities, as given:

Daily demand (nos.)	0	10	20	30	40	50
Probability	0.01	0.20	0.15	0.50	0.12	0.02

Use the following sequence of random numbers to simulate the demand for next 10 days.

Also find out the average demand per day

Random numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49.

[10]

Answer:

(a) Let x be the break-even quantity between automatic and semi-automatic and semi-automatic machines. This means, for volume of output x , the total cost of manufacture is the same on both automatic and semi-automatic and semi-automatic machines.

For quantity = x units

Total manufacturing cost on automatic machines = $(4.0 + 4x / 60) \times 40$

Total manufacturing cost on semi-automatic machines = $(3.0 + 10x / 60) \times 24$

If ' x ' is the break-even quantity, then

$$(4.0 + 4x / 60) \times 40 = (3.0 + 10x / 60) \times 24$$

$$160 + (4x / 60) \times 40 = 72 + (10x / 60) \times 24$$

$$160 + 8x / 3 = 72 + 4x$$

$$4x - 8x / 3 = 72 + 4x$$

$$4x - 8x / 3 = 160 - 72$$

$$4x / 3 = 88$$

$$X = 66 \text{ units.}$$

Hence for quantity upto 65, a semi-automatic machine will be cheaper. For quantity 66, both semi-automatic and automatic machines are equally costly. For quantity more than 66, automatic machine becomes cheaper than semi-automatic machine.

(b) Computation of random numbers range:

Daily demand	Probability	Cumulative Probability	Range of random No.
0	0.01	0.01	0-0
10	0.20	0.21	1-20
20	0.15	0.36	21-35
30	0.50	0.86	36-85
40	0.12	0.98	86-97
50	0.02	1.00	98-99

Simulation the demand for next 10

Days	Random Numbers	Demand
1	25	20
2	39	30
3	65	30
4	76	30
5	12	10
6	05	10
7	73	30
8	89	40
9	19	10
10	49	30
		240

Average demand = $240 / 10 = 24$ days

3. (a) State the eight most Common Benchmarking errors. [8]

(b) PQR Company has kept records of breakdowns of its machines for 300 days work year as shown below:

No. of breakdown	Frequency in days
0	40
1	150
2	70
3	30
4	10
	300

The firm estimates that each breakdown costs ₹650 and is considering adopting a preventive maintenance program which would cost ₹200 per day and limit the number of breakdown to an average of one per day. What is the expected annual savings from preventive maintenance program? [7]

Answer:

(a) The Eight Most Common Benchmarking Errors:

1. Lack of Self-knowledge: Unless own operations are thoroughly analysed, the benchmarking efforts will not pay off. One has to know how things work in a company, how effective current processes are, and what factors are critical. That's why internal benchmarking is an important first step.
2. Benchmarking everything: Be selective. Benchmarking another company's employee food service will usually not be worth the time, energy, and cost. Own TQM effort as a whole will point out the areas where benchmarking is most likely to pay off.
3. Benchmarking projects are broad instead of being focused. The more specific the project, the easier it is and the more likely it will generate useful ideas. Benchmarking a successful company's hiring procedures, not their entire human resources operations. Focus on accounts receivable handling, not the accounting department as a whole.
4. Benchmarking produces reports, not action. Studies have indicated that 50% of benchmarking projects result in no specific changes. The process is not an academic exercise. It should be geared toward generating and implementing actual changes.
5. Benchmarking is not continuous. Benchmarking is a process. Even before one reaches the benchmark one has set, one should take another look at partner's performance, or at other companies. New goals should be established and new techniques adopted. The process never ends.
6. Looking at the numbers, not the issues. While the measures are important, they are not the heart of the process. At some companies, benchmarking is used to set goals, but not to generate the important changes needed to meet them.
7. Participants are not motivated. Make sure benchmarking team members have the time to do the job. Even if the project is simply added on their regular jobs, make sure each has a stake in the success of the project. Benchmarking should not be considered as "busy work" to be assigned to a group of low-level employees.

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8. Too much data. Action is what's important, not information for its own sake. Benchmarking success should not be considered by quantity of information. It is necessary to always focus on key issues.

(b) Step 1: To determine the expected number of breakdowns per year:

No. of breakdowns	Frequency of breakdowns in days i.e., $f(x)$	Probability distribution of breakdowns $P(x)$	Expected value of breakdowns $X P(x)$
0	40	$40/300 = 0.133$	Nil
1	150	$150/300 = 0.500$	0.500
2	70	$70/300 = 0.233$	0.466
3	30	$30/300 = 0.100$	0.300
4	10	$10/300 = 0.033$	0.132
Total	300	1.000	1.400

Step 2:

$$\text{Total no. of breakdowns per day} = 1.40$$

$$\text{Cost of breakdown per day} = 1.40 \times 650 = ₹910$$

$$\text{Cost of preventive maintenance programme per day} = ₹200 + ₹650 = ₹850$$

$$\begin{aligned}\text{Expected annual savings from the preventive maintenance programme} \\ &= (910 - 850) \times 300 \text{ days} \\ &= 60 \times 300 = ₹18,000\end{aligned}$$

4. (a) A department works on 8 hours shift, 288 days a year and has the usage data of a machine, as given below:

Product	Annual Demand (units)	Processing time (Standard time in hours)
A	325	5.0
B	450	4.0
C	550	6.0

Calculate (i) processing time needed in hours to produce products A, B, and C, (ii) Annual production capacity of one machine in standard hours, and (iii) Number of machines required. [8]

(b) Discuss the objectives of the Material Requirement Planning.

[7]

Answer:

- (a)** (i) The processing time needed in hours to produce products A, B and C in the quantities demanded using the standard time data:

Product	Annual Demand (units)	Processing time (standard time in hours)	Processing time needed (hrs.)
A	325	5.0	$325 \times 5 = 1,625$
B	450	4.0	$450 \times 4 = 1,800$
C	550	6.0	$550 \times 6 = 3,300$
			Total = 6,725 hrs.

(ii) annual production capacity of one machine in standard hours = $8 \times 288 = 2,304$ hours per year.

(iii) Number of machines required = Work load per year / production capacity per machine = $6,725 / 2,304 = 2.92$ machines = 3 machines

- (b)** MRP is a technique of working backward from the scheduled quantities and needs dates for end items specified in a master production schedule to determine the

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requirements for components needed to meet the master production schedule. The technique determines what components are needed, how many are needed, when they are needed and when they should be ordered so that they are likely to be available as needed.

MRP Objectives:

- (i)** 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.
- (ii)** 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 prioritizes production activities by putting due dates on customer job orders.
- (iii)** Realistic Delivery Commitments: By using MRP, production can give marketing timely information about likely delivery times to prospective customers.
- (iv)** Increased Efficiency: MRP provides a close coordination among various work centers and hence helps to achieve uninterrupted flow of materials through the production line. This increases the efficiency of production system.

Section – C

III. Answer any two question from the following:

[15×2=30]

- 1. (a) Explain Relational Data Base Management System.** [6]
- (b) List the tangible benefits of ERP.** [5]
- (c) State when DBMS should not be used.** [4]

Answer:

(a) RDBMS – Relational Data Base Management System or Relational DBMS

A DBMS has to be persistent, that is it should be accessible when the program created the data ceases to exist or even the application that created the data restarted. A DBMS also has to provide some uniform methods independent of a specific application for accessing the information that is stored.

RDBMS adds the additional condition that the system supports a tabular structure for the data, with enforced relationships between the tables. This excludes the databases that don't support a tabular structure or don't enforce relationships between tables.

DBMS does not impose any constraints or security with regard to data manipulation it is user or the programmer responsibility to ensure the ACID PROPERTY of the database whereas the RDBMS is more with this regards because RDBMS defines the integrity constraint for the purpose of holding ACID PROPERTY. RDBMS may be or may not be Client Server Database System.

(b) Tangibles benefits of ERP:

- (1) Reduced level of inventory, including raw material, work in progress and finished goods, through improved planning and control.**

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- (2) Reduced materials cost through improved procurement and accounts payable practices, less obsolescence and wastage.
- (3) Reduced labor cost through better allocation and reduction of overtime of workmen directly involved with production such as technicians and skilled workers.
- (4) Improved production throughput through better scheduling of critical equipment and sub-contracting operations, thereby minimizing shortages, interruption and rework.
- (5) Reduction in the cost of after sales services.

(c) When Not to Use a DBMS:

In spite of the advantages of using a DBMS, there are a few situations in which such a system may involve unnecessary overhead costs as that would not be incurred in traditional file processing. The overhead costs of using a DBMS are due to the following:

- High initial investment in hardware, software, and training.
- Generality that a DBMS provides for defining and processing data.
- Overhead for providing security, concurrency control, recovery, and integrity functions.

Additional problems may arise if the database designers and DBA do not properly design the database or if the database systems applications are not implemented properly. Hence, it may be more desirable to use regular files under the following circumstances:

- The database and applications are simple, well defined, and not expected to change.
- There are stringent real-time requirements for some programs that may not be met because of DBMS overhead.
- Multiple-user access to data is not required.

2. (a) Define EIs and List the special features of and EIS.

[2+5=7]

(b) List the major constraints in operating MIS.

[8]

Answer:

(a) 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 is 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.

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(b) Major constraints which come in the way of operating and information system are:

- Non-availability of experts, who can provide a desired direction for installing and operating the system aligning with the objectives of the organization. This problem may be overcome by grooming internal staff. The grooming of staff should be done by proper selection and training.
- Approach adopted by experts for designing and implementing MIS is a non-standardized one. Standardization may be arrived for the organizations in the same industry.
- Non-availability of cooperation from staff is a critical problem. The problem may be solved by educating the staff about the utility of MIS. The task should be carried out by organizing lectures, and explaining the utility of the system. Some persons from staff should also be involved in the development and implementation of the system.
- There is high turnover of experts in MIS. This problem can be handled by creating the better working conditions and paying at least at par with similar organizations.
- There is a difficulty in quantifying the benefits of MIS, the constraints can be resolved by education the top managers and telling them about the advantages of MIS.

3. (a) List the advantages & disadvantages in E-commerce.

[8]

(b) State the benefit of Business Intelligence (BI).

[7]

Answer:

Advantages and disadvantages of E-commerce are as follows:

(a) Advantages:

- Business without the barriers of time or distance
- Lower cost-of-sale
- Cheapest means of doing business
- Many advantages to buyer e.g. better buyer decisions, saving in time and efforts, increased opportunities for buying alternative products, etc.
- Less delivery time, labour cost etc.
- Price economy to buyer due to increased competition and reduction in costs.

Disadvantages:

- Few people are using E-commerce due to insufficient computer literacy and availability of internet / computer etc.
- Unable to personally examine the product
- Requirement of special hardware and software
- Maintenance of website
- Training and maintenance of skilled personnel
- Not suitable for perishable commodities
- Delivery time may require efforts at buyers' end
- Efforts in case of return of goods and getting of refund
- Problems of E-record.

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- (b)** The benefits of business Intelligence (BI) are as follows
- I. Time savings
 - II. Single version of truth
 - III. Improved strategies and plans
 - IV. Improved tactical decisions
 - V. More efficient process
 - VI. Cost savings
 - VII. Faster, more accurate reporting
 - VIII. Improved decision making
 - IX. Improved customer service
 - X. Increased revenue