PAPER – 9 – OPERATIONS MANAGEMENT & INFORMATION SYSTEMS

Paper – 9 – Operations Management & Information Systems

Full Marks: 100   **Time Allowed: 3 hours**

All questions are compulsory, subject to instruction provided against each question. All workings must form part of your answer. Assumptions, if any, must be clearly indicted.

Section A

I. Answer the following question which is compulsory:

1. Answer all the questions: **[2 × 10 = 20]**

   a) Customer Satisfaction:
      The first objective of operating system is to utilize resources for the satisfaction of customer wants customer service id therefore a key objective of operations management.
      Optimal Utilization of resource:
      Operations management is concerned essentially with the utilization of resources.

   b) Efficiency is ratio of the actual output of a process relative to some standard efficiency is used to measure the loss or gain in a process.
      Efficiency = Standard time / Actual time.
                          or
      Efficiency = Actual output / Standard output.

   c) Applications of PERT: PERT is useful in the following situations:
      (i)   The project should have identifiable activities.
      (ii) The activities should have clear starting and ending points.
      (iii) Project is complicated and consists of many inter-related tasks.
      (iv) Technique is good for projects, where alternative options, sequence of activities and time period involved.

   (d) Monte Carlo method is also called computer simulation, it can described as a numerical technique that involves modeling a stochastic system with the objective of predicting the system's behavior. The chance element is a very significant feature of Monte Carlo simulation and this approach can be used when the given process has a random, or chance, component. In using the Monte Carlo method, a given problem is solved, by simulating the original data with random number generators.

   (e) According to the formal definition given by union of Japanese Scientists and Engineers (JUSE) "Quality circle is a small group formed to perform voluntarily QC activities leading to self development within the work place.

   (f) Benefits of preventive Maintenance:
      Preventive maintenance offers several benefits to the users. They include greater safety for workers, decreased production downtime, fewer large scale and repetitive repairs, less cost for simple repairs made before breakdown, less cost for simple repairs made before breakdown, less standby equipment required, better spare parts control, identification of items with high maintenance costs, and lower unit cost of manufacture.

   (g) The characteristics of good quality communications are correctness, completeness, timelyness, understandability and simplicity.

(h) Database system contains not only the database itself but also a complete definition or description of the database structure and constraints. This definition is stored in the system catalogue, which contains various information. The information stored in the catalog is called meta-data, and it describe the structure of the primary database.

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

(j) Main Reasons for the spread of E-Commerce
   (i) Digital convergence, i.e., it means that due to digital revolution almost all digital devices can communicate with one another.
   (ii) Today's E-Commerce is available to anyone, anywhere in the world, anytime 24/7 (24 hours a day, 7 days a week).

2. Match List A with List B [5 × 1 = 5]

List A	List B
a) Load Control	1) Bottleneck center
b) Linear Programming (LP)	2) Product Mix determination
c) Vogel's Approximation Method (VAM)	3) Transportation Application
d) Information	4) Refined data
e) Primary Key	5) Digital Signature

II. Answer any three question [15 × 3 = 45]

1. (a)

	Patna	Ranchi	Dhanbad
Fixed Cost	30 Lakhs	50 Lakhs	25 Lakhs
Variable Cost	₹ 300	₹ 200	₹ 350
Selling Price	₹ 700	₹ 700	₹ 700

Total Cost = Fixed Cost + (Variable Cost × n)
Total Cost at Patna = 30,00,000 + (300 × n)   (1)
Total Cost at Ranchi = 50,00,000 + (200 × n)   (2)
Total Cost at Dhanbad = 25,00,000 + (350 × n)   (3)

Total cost at Patna, Ranchi & Dhanbad for various ranges of production 5,000, 10,000, 15,000, 20,000 & 25,000.

Location	5,000	10,000	15,000	20,000	25,000
Patna	45,00,000 (30,00,000 + 300 × 5,000)	65,00,000 (30,00,000 + 300 × 10,000)	75,00,000 (30,00,000 + 300 × 15,000)	90,00,000 (30,00,000 + 300 × 20,000)	1,05,00,000 (30,00,000 + 300 × 25,000)
Ranchi	60,00,000 (50,00,000 + 200 × 500)	70,00,000 (50,00,000 + 200 × 10,000)	80,00,000	90,00,000	1,00,00,000
Dhanbad	42,50,000 (25,00,000 + 350 × 5,000)	60,00,000	77,50,000	95,00,000	1,12,50,000

Rules: 1. Upto 10,000 units Dhanbad is suitable.
         2. 10,000 to 20,000 units Ranchi is suitable.

3. Above 20,000 units Ranchi is suitable.

∴ For 18,000 units Patna is suitable.

At 18,000 Patna 84 lakhs, Ranchi 86 lakhs & Dhanbad 88 lakhs.

(b) Critical Ration (CR) = $\dfrac{\text{Time Remaining}}{\text{Work Remaining}} = \dfrac{d_j}{t_j}$

Jobs	Due Date	Time Remaining (dj)	Work Remaining (tj)	Cr =
A	August 12	11	2	$\dfrac{11}{2} = 5.50$
B	August 7	6	6	$\dfrac{6}{6} = 1$
C	August 4	3	7	$\dfrac{3}{7} = 0.43$
D	August 8	7	12	$\dfrac{7}{12} = 0.58$

The Table is as on August 1st.

C	→	D	→	B	→	A
0.43		0.58		1		5.50

If Cr = 1	Job is on schedule
Cr < 1	Job is already late
Cr > 1	Job is some slack

2. (a) Loss Matrix

0	7	14	21
12	17	22	27
12	17	22	27
18	22	26	30

Row Operation

0	7	14	21
0	5	10	15
0	5	10	15
0	4	8	12

Column Operation

0	3	6	9
0	1	2	3
0	1	2	3
0	0	0	0

Improved Matrix

0	2	6	9
0	0	2	3
0	0	2	3
1	0	0	0

Further Improved

[0]	2	4	7
0	[0]	0	1
0	0	[0]	1
2	1	0	[0]

Assignment

Job	Machine	Profit
I	1	42
II	2	25
III	3	20
IV	4	12
Total Profit = 99		99

(b)   Work center

Raw Material → $\boxed{A}$ → $\boxed{B}$ → $\boxed{C}$ → $\boxed{D}$ → Actual Output

              450   360   340   400   300
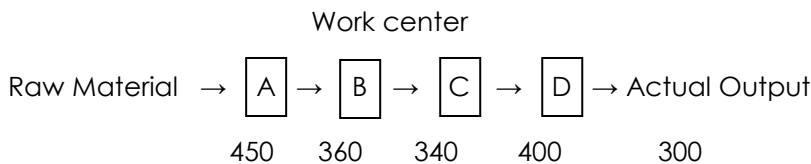
(a) Bottleneck Center:
   A center with low processing speed in the sequence is known as bottleneck center. In the above sequence C is the lowest processing center in the sequence. So "C" is the bottleneck center.

(b) System Capacity:
   Bottleneck center capacity is the system capacity in the above sequence C is the bottleneck center whose capacity is 340 units. So system capacity is 340 units.

(c) System efficiency = $\dfrac{\text{Actual Output}}{\text{System Capacity}}$ = $\dfrac{300}{340}$ = 88.23%.

3. (a) (i)

Activity	Machine K	Machine L
Interest 15%	9,000 (60,000 × 0.15)	15,000 (1,00,000 × 0.15)
Operating Cost per annum	48,000 (4,000 × 12)	40,000 (4,000 × 10)
Total Annual Charges	57,000	55,000
Annual Output (Prodn. Per Hour × No. of Hours Worked)	24,000 (6 × 4,000)	40,000 (10 × 4,000)
Cost per unit (Cost/Volume)	₹ 2.375 (57,000/24,000)	₹ 1.375 (55,000/40,000)

∴ Machine 'L' is suitable for regular production.

(ii) If only 4,000 pieces are to be produced.

Activity	K	L
Interest @ 15%	9,000	15,000
Operating Cost : ($\dfrac{\text{Production Required}}{\text{Production Per Hour}}$)× Price Per Hour	8,000 [($\dfrac{4000}{6}$ × 12)]	4,000 [($\dfrac{4000}{10}$ × 10)]
Total Cost	17,000	19,000
Cost Per unit	₹ 4.25	₹ 4.75

∴ For 4000 piece 'K' is suitable.

(iii) BEP between two machines K, L.

$$N = \frac{F_2 - F_1}{V_1 - V_2}$$

$$= \frac{15000 - 9000}{2 - 1}$$

$$= \frac{6000}{1}$$

= 6000 units.

(b) Scope of Maintenance:

Every manufacturing organization needs maintenance because machines break down, parts wear out and buildings deteriorate over a period of time of use. All segments of a factory – buildings, machinery, equipments, tools, cranes, jigs and fixtures, heating and generating equipments, waste disposal systems, air-conditioning equipments, wash rooms, dispensaries and so on need attention.

Maintenance covers two broad categories of functions s outlined below:

(a) Primary Functions:
   (i) Maintenance of existing plant and equipment
   (ii) Maintenance of existing plant buildings and grounds
   (iii) Equipment inspection and lubrication.
   (iv) Utilities generation and distribution.
   (v) Alterations to existing equipments and buildings.
   (vi) New installations of equipments and buildings.

(b) Secondary Functions
   (i) Storekeeping (Keeping stock of spare parts)
   (ii) Plant protection including five protection.
   (iii) Waste disposal
   (iv) Salvage
   (v) Insurance administration (against five, theft etc.)
   (vi) Janitorial service
   (vii) Property accounting
   (viii) Pollution and noise abatement or control.
   (ix) Any other service delegated to maintenance by plant management.

4. (a) Basic types of production control can be of six types:
   Block control:
   This type of control is most prominent in textiles and book and magazine printing. In these industries it is necessary to keep things separated and this is the fundamental reason why industries resort to block control.

   Flow Control
   This type of control is commonly applied in industries like chemicals, petroleum, glass, and some areas of food manufacturing and processing. Once the production system is thoroughly designed the production planning and control department controls the rate of flow of work in to the system and checks it as it comes out of the system. But, under this method, routing and scheduling are done when the plant is laid out. That is to say, the production line which is established is well balanced and sequenced before production operations begin this type of control is more prevalent in continuous production systems.

Load Control:
Load control is typically found wherever a particular bottleneck machine exists in the process of manufacturing.

Order control:
The most, common type of production control is called order control. This type of control is commonly employed in companies with intermittent production systems, the so-called job-lot shops. Under this method, orders come into the shops for different quantities for different products. Therefore, production planning and control must be based on the individual orders.

Special project control:
Special production control is necessary in certain projects like the construction of bridges, office buildings, schools, colleges, universities, hospitals and other construction industries. Under this tooling and scheduling, a man or group of men keeps in close contact with the work.

Batch Control:
Batch control is another important, type of production control which is frequently found in the food processing industries. Thus, production control in batch-system of control operates with a set of ingredients that are proportionally related and handled one batch at a time.

(b) Principles of Layout:

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

Section C

III. Answer any two questions   **[15 × 2 = 30]**

1. (a) System:
       A system is a collection of inter-related and inter-dependent elements or components that operate collectively to achieve some common purpose a goal. For example: Human body, computer system.

A computer based information system is also a system consist of collection of people, hardware, software data procedure that interact to provide timely information to authorized people for such decision making and for the other purposes.

Open System:
(a) An open system is one which interacts which its environments and can change itself to accommodate the changes in factors like customer's performance, price. Product design etc.
(b) The adoptability of an open system is judged by its capability in modifying the operational parameters of the system accordingly.
(c) It takes input from outside and Exports output to outside.
(d) For example: Human body changes as per weather conditions.
(e) If a system can accommodate all the changes in the environmental factors as and when required, is said to be perfectly open system.
(f) All systems in the universe are open systems.

Closed System:
(a) A closed system is one which does not have any interaction with outside environment.
(b) Closed systems functions in the closed environment set and is insular with the change in the environment.
(c) A closed system is a self contained one and normally a rigid one.
(d) There is no closed system. Some system in Military or Defence Service may be closed system partially.

(b) Information System Infrastructure:

Information system infrastructure means the physical resources and organizational support required for operation of an information system.

Basic Components: It consists of following six basic components:
➢ Hardware – Devices which store software, database of processed data.
➢ Software – Programs that process data to generate reports.
➢ Database – Data collection is stored in database.
➢ Network - Technology for sharing the data and other hardware resources.
➢ People – Human resources to making the system operational.
➢ Report – Report are generated by the software with the help of database for the use by users (people).
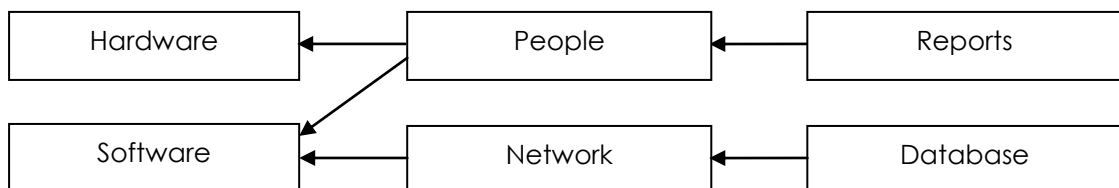
2. The role of information system architecture is to support and reinforce (strength) the organization structure and decision making mechanism.
3. The change in management is the critical issue and change in the architecture should be taken up well before the technology becomes obsolete (outdated).
4. Management had to ensure that hardware should suitable to fulfill the information requirement for decision making.
5. The choice between centralized processing or distributed processing has to be made first.
6. The architecture design is dominated by issue of compatibility of hardware platform and software package.

7. Software requirement in compatible with hardware.
8. Networking and communication technology requirement
9. Assessment of investment requirement and phasing the investment
10. Vendor selection
11. Procurement plan.

(c) x – y Relation

Batch No.	Course
1	BA
3	BCA
6	MBA

2. (a) The goal of the three-schema architecture, is to separate the user applications and the physical database. In this architecture, schemes can be defined at the following three levels:

(1) The interval level has an internal schema, which describe the physical storage structure of the database.
(2) The conceptual level has a conceptual schema, which describes the structure of the whole database for a community of users.
(3) The external or views level includes a number of external schemes or user views.
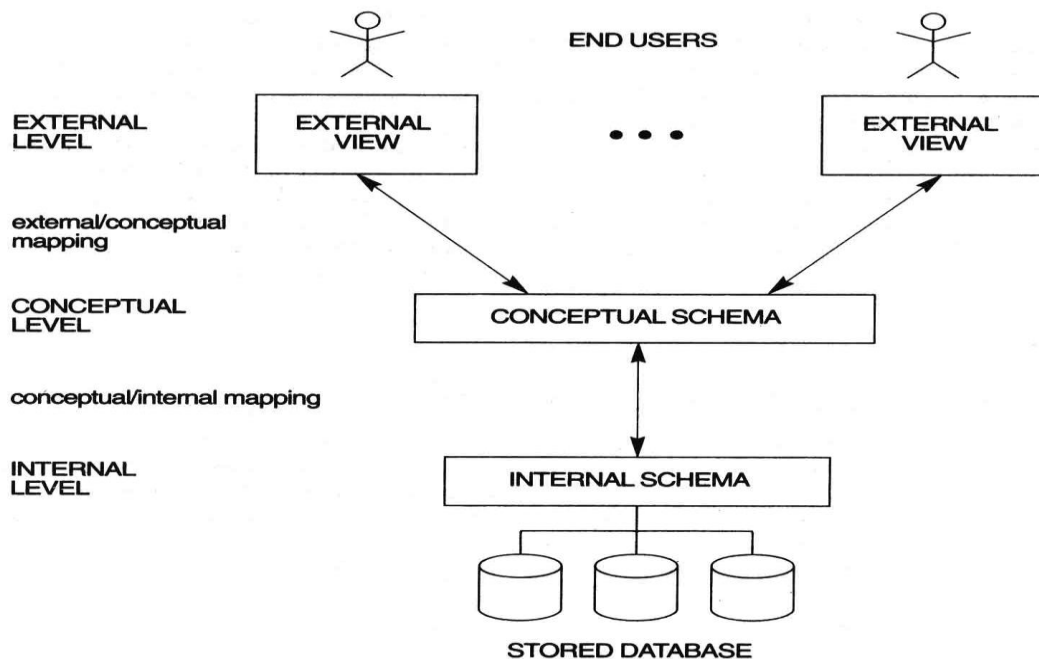
(b) Major features of ERP:

(i) ERP provides multi-platform, multi-mode, manufacturing, multicurrency, multi-lingual facilities.
(ii) It supports strategic and business planning activities, operational planning and execution activities, creation of materials and resources. All these functions are effectively integrated for flow and update of information immediately upon entry of any information.
(iii) Has end to end supply chain management to optimize the overall demand and supply data.

(iv) ERP facilitates company-wide integrated information system covering all functional areas like manufacturing, selling and distribution, payables, receivables, inventory accounts, human resources, purchases etc.

(v) ERP performs core activities and increases customers service, thereby augmenting the corporate images.

(vi) ERP bridges the information gap across organizations.

(vii) ERP provides complete integration of systems not only across departments but also across companies under the same management.

3. (a) E-Commerce has several advantages:

Business without the barriers of time or distance:
E-commerce plays very important role in allowing people to carryout businesses without the barriers of time or distance. One can log on to the internet at any time, whether day or night and purchase or sell anything at his desires.

Lower cost-of-sale:
As there is no human interaction (whole seller, retailer etc.) during the on-line electronic purchase order process. Therefore, the direct cost-of-sale for an order taken from a web-site is lower than through traditional means. Further, electronic selling also eliminates processing errors, and is also more convenient for the visitor.

Cheapest means of doing business:
Another important benefit of E-commerce is that as compare to paper based commerce it is the cheapest means of doing business.

Advantages of buyer:
From the "buyer" perspective also E-Commerce offers a lot of advantages.

(i) Reduction in buyer's sorting out time.
(ii) Better buyer decisions.
(iii) Less time is spent in resolving invoice and order discrepancies.
(iv) Increased opportunities for buying alternative products.

Less delivery time, labour cost etc.:

A significant benefit of E-Commerce is that it helps to reduce the delivery time, labour cost and the cost incurred in the following areas'.

(i) Document preparation.
(ii) Errors detection and correction.
(iii) Mail preparation
(iv) Communication
(v) Data Entry
(vi) Overtime for completing the work; and
(vii) Supervision expenses

Price Fixation:
The day-to-day pressures of the market place have played their part in reducing the opportunities for companies to invest in improving their competitive position. A matured market, increased competitions have reduced the amount of money available to invest. If the selling price cannot be increased and the manufactured cost cannot be decreased then the difference can be in the way the business is carried out. E-Commerce has provided the solution by decimating the costs, which are incurred.

(b) Flow chart is a pictorial representation of algorith. It represents flow of logic and flow of data in diagrammatical fashion.

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                          ┌─────────┐
                          │  Start  │
                          └────┬────┘
                               ↓
                        ┌──────────────┐
                        │ Read a, b, c │
                        └──────┬───────┘
                               ↓
              N          ╱────────────╲          Y
        ┌───────────────<   Is a > b   >───────────────┐
        ↓                 ╲────────────╱                ↓
        │                       N                       │
   Y  ╱──────╲  N                                  N  ╱──────╲  Y
 ┌───< Is b>c >───┐                             ┌────< Is a>c >────┐
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┌──────────────┐ ┌──────────────┐            ┌──────────────┐ ┌──────────────┐
│Print "b is big"│ │Print "c is big"│        │              │ │Print "a is big"│
└──────┬───────┘ └──────┬───────┘            └──────┬───────┘ └──────┬───────┘
       ↓                ↓                            ↓                ↓
   ┌───────┐        ┌───────┐                                    ┌───────┐
   │ Stop  │        │ Stop  │                                    │ Stop  │
   └───────┘        └───────┘                                    └───────┘
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Print "c is big" → Stop