Paper 9 - Operations Management & Information Systems

Time allowed-3hrs   Full Marks: 100

Section I
(Operations Management)
Answer Question No. 1 which is compulsory and answer any two from the rest, under Section I.

Working Notes should form part of the answer.

1. (a) Fill in the blanks given below: [1 x 7 =7]

   (i) --------------- is a technique by which a large number of instantaneous observations are made over a period of time of group of workmen, processes or machine.
   (ii) --------- Analysis is a rule that recommends focus on the most important aspect of decision making, in order to simplify the process of decision –making.
   (iii) The Spur Gears have their teeth -------- to the axis of rotation of the gear.
   (iv) ------------- planning is an intermediate term planning decision.
   (v) Quality ------------- deals with the present and focuses to create and operate appropriate systems to prevent defects from occurring.
   (vi) The --------- Technique is a way to obtain the opinion of experts without necessarily bringing them together face to face.
   (vii)Technology Life Cycle comprises of 4 stages, viz. , Innovation, ------------ , Diffusion and Substitution.

   (b) Expand the following abbreviations: [1 x 7 =7]

   (i) PERT
   (ii) MTM
   (iii) CRAFT
   (iv) AOQ
   (v) LRC
   (vi) FMEA
   (vii)CIM

Answer:

1. (a) (i) Activity Sampling
        (ii) Pareto
        (iii) parallel
        (iv) Aggregate
        (v) Assurance
        (vi) Delphi
        (vii) Syndication

   (b) (i)   Programme Evaluation and Review Technique
       (ii)   Method Time Measurement
       (iii) Computerised Relative Allocation of Facilities Techniques
       (iv)   Average outgoing Quality
       (v)   Linear Responsibility Chart

(vi)   Failure Mode and Effects Analysis
(vii)   Computer Integrated Manufacturing

2. **(a) A city hospital has the following minimal daily requirement for nurses:**

Period	Clock time (24 hours day)	Minimal number of nurses required
1	6 AM - 10 AM	2
2	10 AM - 2 PM	7
3	2 PM- 6 PM	15
4	6 PM-10 PM	8
5	10 PM – 2 AM	20
6	2 AM - 6 AM	6

Nurses report to the hospital at the beginning of each period and work for consecutive 8 hours. The hospital wants to determine the minimal number of nurses to be employed so that there will be sufficient number of nurses available for each period. Formulate LPP. Do not solve.   **[6]**

(b) ABC airline operating 7 days a week has given the following time table. Crews must have a minimum layover of five hours between the flights. Obtain the pairing flights that minimize the layover time away from home. For any given pairing the crew will be based at the city that results in the smaller layover.

HYDERABAD - DELHI			HYDERABAD - DELHI		
Flight No.	Departure	Arrival	Flight No.	Departure	Arrival
A1	6 AM	8 AM	B1	8 AM	10 AM
A2	8 AM	10 AM	B2	9 AM	11AM
A3	2 PM	4 PM	B3	2 PM	4 PM
A4	8 PM	10 PM	B4	7 PM	9 PM

[12]

   Answer:

(a)

   Let the number of nurses reporting at 6 AM = x_1

   Let the number of nurses reporting at 10 AM = x_2

   Let the number of nurses reporting at 2 PM = x_3

   Let the number of nurses reporting at 6 PM = x_4

   Let the number of nurses reporting at 10 PM = x_5

   Let the number of nurses reporting at 2 AM = x_6

Objective function: Minimize $x_1 + x_2 + x_3 + x_4 + x_5 + x_6$.

Subject to: →	(i) $x_6 + x_1 \geq 2$	(ii) $x_1 + x_2 \geq 7$	(iii) $x_2 + x_3 \geq 15$
(iv) $x_3 + x_4 \geq 8$	(v) $x_4 + x_5 \geq 20$	(vi) $x_5 + x_6 \geq 6$	(vii) $x_1, x_2\ x_3, x_4, x_5, x_6 \geq 0$

(b)

Layover time (Hyderabad based crew)						Layover time (Delhi based crew)				
Flight No.	**B1**	**B2**	**B3**	**B4**		**Flight No.**	**B1**	**B2**	**B3**	**B4**
A1	24	25	6	11		A1	20	19	14	9
A2	22	23	28	9		A2	22	21	16	11
A3	16	17	22	27		A3	18	27	22	17
A4	10	11	16	21		A4	10	9	28	23

Minimum time						Row subtraction				
Flight No.	**B1**	**B2**	**B3**	**B4**		**Flight No.**	**B1**	**B2**	**B3**	**B4**
A1	24	25	6	11		A1	20	19	14	9
A2	22	23	28	9		A2	22	21	16	11
A3	16	17	22	27		A3	18	27	22	17
A4	10	11	16	21		A4	10	9	28	23

As there is zero in each column, column subtraction is not required.

Minimum No. of lines

Flight No.	B1	B2	B3	B4
A1	14	13	0	3
A2	13	12	7	0
A3	0	1	6	1
A4	1	0	7	12

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

Optimal assignment

Flight No.	B1	B2	B3	B4
A1	14	13	[0]	3
A2	13	12	7	[0]
A3	[0]	1	6	1
A4	1	[0]	7	12

Pair	
A1- B3	6 hours at Delhi (Hyderabad based crew)
A2- B4	9 hours at Delhi (Hyderabad based crew)
A3- B1	16 hours at Delhi (Hyderabad based crew)
A4- B2	9 hours at Hyderabad (Delhi based crew)
Total	40 hours

3.(a) The following activities must be accomplished in order to complete a construction project:

Activity	A	B	C	D	E	F	G	H	I	J
Time	3	8	4	2	1	7	5	6	8	9
Predecessors	—	—	AB	B	A	C	EF	DF	GH	I

- Construct a network diagram for this project. Find the CP and the duration of the project.
- Assume that you are project manager of the project mentioned above. The project has progressed for 10 weeks and the status is follows:

Activities completed: A, B, E. Other activities have not started as yet.

- ❖ If no managerial action is taken at all when will the project get completed?
- ❖ What action might you take to get the project back to a schedule that can be completed by the end of week 42? **[5+5=10]**

(b) An analyst has observed a job long enough to become familiar with it and has divided it into five elements. The element times for the first four cycles and a performance rating for each element are given in the following table:

Element	Cycle-1	Cycle-2	Cycle-3	Cycle-4	Performance Rating(%)
1	1.246	1.328	1.298	1.306	90
2	0.972	0.895	0.798	0.919	100
3	0.914	1.875	1.964	1.972	100
4	2.121	2.198	2.146	2.421	110
5	1.253	1.175	1.413	2.218	100

- Compute an estimated normal time for the job based on the data available at this stage of the study. **[4]**

(c) A department works on 8 hours shift, 250 days a year and has the usage data of a machine, as given below:

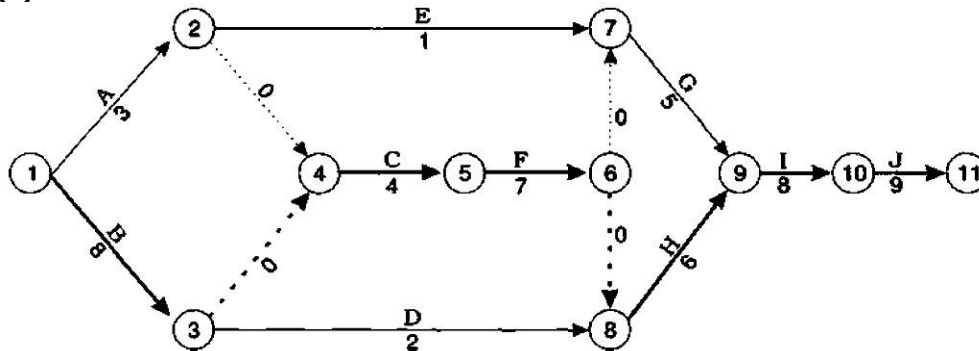| Product	Annual demand (units)	Processing time (Standard time in hours)
A	600	4.0
B	800	6.0
C	1000	3.0

Determine the number of machines required. [4]

Answer:

(a)

Paths	Duration (weeks	Paths	Duration (weeks)
1-2-7-9-10-11	26	1-3-4-5-6-7-9-10-11	41
1-2-4-5-6-7-9-10-11	36	1-3-4-5-6-8-9-10-11	42
1-2-4-5-6-8-9-10-11	37	1-3-8-9-10-11	33
Critical Path: BCFHIJ. Duration 42 weeks.			
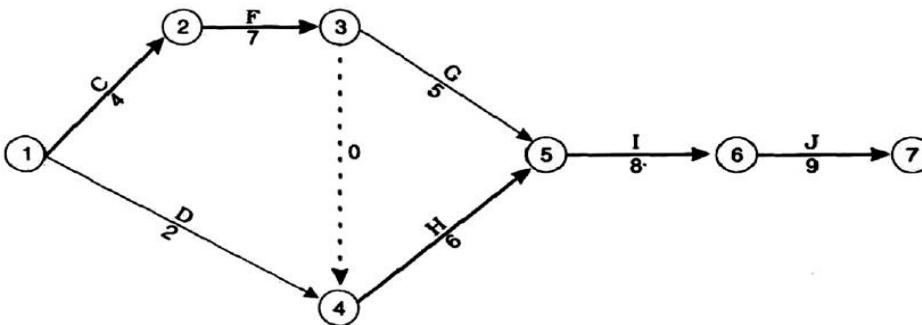
Paths	1-2-3-5-6-7	1-2-3-4-5-6-7		1-4-5-6-7
Duration (weeks)	33	34	**Critical Path: CFHIJ**	25

For completing the project as per original schedule, the project activities on the critical path should be reduced by 2 weeks. For example, we may reduce any one of the activities CFHIJ by 2 days or any two activities or one reek each.

(b)

Element	Mean actual time	Performance rating (%)	Normal time
1	1.295	90	1.165
2	0.896	100	0.896
3	1.681	100	1.681

4	2.222	110	2.444
5	1.512	100	1.512

Normal time for total job = 7.698

(iii)

Step 1: Calculate the processing time needed in hours to produce product X, Y and Z in the quantities demanded using the standard time data.

Product	Annual demand(units)	Standard Processing time per unit (hrs.)	Processing time needed (hrs.)
A	600	4.0	600 x 4= 2,400
B	800	6.0	800 x 6= 4,800
C	1000	3.0	1000 x 3= 3,000
			Total= 10,200

Step 2 : Annual production capacity of one machine in standard hours = 8 × 250 = 2000 hours per year.

Step 3 : Number of machines required = Work load per year/Production capacity per machine
= 10,200/2000
= 5.1 machines = 5 machines.(approx)

4. (a) Describe the term Commercialisation in relation to planning of products. [5]
(b) Define Process Strategy and name its key aspects. [3]
(c) List the benefits of Production Control. [6]
(d) State the limitations of Production Planning and Control. [4]

Answer:

(a) In this stage the product is submitted to the market, and thus commences its life-cycle. Commercialisation is also the phase where marketing is most active in connection with the new product. This stage is considered to be a critical one for any new product and should therefore be handled carefully. For instance, it should be checked whether advertising and personal selling have been done effectively and whether proper outlets have been arranged for the distribution. Despite the care with which the previous development stages have been planned, unforeseen events can impair commercialisation seriously. The following activities are usually undertaken during this stage:
  i.   Completing final plans for production and marketing.
  ii. I nitiating coordinated production and selling programmes.
  iii. Checking results at regular intervals.
I t should be remembered that new products should be launched in the market only stage by stage. In other words, introduction may be restricted to a few regions in the first instance. This is to avoid short supply of the product due to initial gaps in production and distribution. It is not prudent to extend a product nationally and then not be able to meet demand or to come across some unexpected deficiency.

(b) A **process strategy** is an organisation's approach to process selection for the purpose of transforming resource inputs into goods and services (outputs). The objective of a process strategy is to find a way to produce goods and services that meet customer requirement and product specification (i.e., design specifications) within the constraints of cost and other managerial limitations. The process selected will have a long-term effect on efficiency and production as well as flexibility, cost, and quality of the goods produced. Hence it is necessary that a firm has a sound process strategy at the time of selecting the process.

Key aspects in process strategy include:
(i) Make or buy decisions
(ii) Capital intensity and
(iii) Process flexibility

(c) Benefits of Production Control

Improvement in profits through -
(i) Maintenance of a balanced inventory of materials, parts, work-in-process and finished goods.
(ii) Balanced and stabilized production.
(iii) Maximum utilization of equipment, tooling, labour (manpower) and storage space.
(iv) Minimum investment in inventory.
(v) Reduction in indirect costs.
(vi) Reduction in set up costs.
(vii) Reduction in scrap and rework costs.
(viii) Reduction in inventory costs.

Competitive advantage-
(i) Reliable delivery to customers.
(ii) Shortened delivery schedules to customers.
(iii) Lower production costs and greater pricing flexibility.
(iv) Orderly planning and marketing of new or improved products.

(d) Limitations of PPC:

(i) Production planning and control function is based on certain assumptions or forecasts of customers' demand, plant capacity, availability of materials, power etc. If these assumptions go wrong, PPC becomes ineffective.
(ii) Employees may resist changes is production levels set as per production plans if such plans are rigid.
(iii) The production planning process is time consuming when it is necessary to carry out routing and scheduling functions for large and complex products consisting of a large no. of parts going into the product.
(iv) Production planning and control function becomes extremely difficult when the environmental factors change very rapidly such as technology, customers' taste regarding fashion or style of products needed, Government policy and controls stoppages of power supply by electricity boards due to power cuts, break in supply chain due to natural calamities such as floods, earthquakes, war etc.

Section II
Information System
Answer Question No. 5 which is compulsory and answer any two from the rest, under Section II.

5. (a) Fill in the blanks given below : [1 x 10 =10]

(i) Network Topology refers to the ---------- arrangement of computer resources, remote devices and communication facilities.

(ii) ---------- publishing is the use of a computer to prepare printed output, using software with sophisticated publishing capabilities.

(iii) Firewall is used to protect the firm's ---------- resources from access by unauthorized user.

(iv) During --------- operations, the mistakes detected are often not those of the new system, but of the old.

(v) -------- control is used as detective control.

(vi) A ---------- is responsible for the performance, integrity and security of a database.

(vii) -------disks are used by end user companies to store their own proprietary information.

(viii) Magnetic tapes are ---------- media and stores the records physically one after the other.

(ix) After -----------,Operating System from hard disk is loaded into Ram to put the computer in operation.

(x) Digital signature is created by using a -------- result which is unique to both the signed message and a given private key.

(b) Expand the following abbreviations: [1 x 4 =4]

(i) SRAM
(ii) CODASYL
(iii) HTML
(iv) OAS

Answer:

(a) (i) geometrical
(ii) Desktop
(iii) internal
(iv) parallel
(v) Audit Trail
(vi) database administrator
(vii) WORM
(viii) sequential
(ix) bootstrapping
(x) hash

(b)(i) Static Random Access Memory
(ii) Committee of Conference on Data System Language
(iii) Hyper Text Markup Language
(iv) Office Automation System

6. (a) List Codd's Rules as designed for stable structure of Relational Database. [8]
(b) State the points required for developing scientific codification. [5]
(c) Discuss the major areas of internal control system. [5]

Answer:

(a) Dr E F Codd first introduced relational database model in 1970. Codd's Rules are designed for stable structure for Relational Database. Rules are :

1. Information Rule – All information is explicitly and logically represented in tables as data values.

2. Guaranteed Access Rule – Every item of data must be logically addressable with the help of table name, primary key value and column name.

3. Systematic Treatment of Null Values Rule – RDBMS must support null values to represent missing or inappropriate information.

4. Database Description Rule – Description of database should follow the same logical structure with which the data are defined in RDBMS.

5. Comprehensive Data Sub Language Rule – The system must support the following :
• Data Definition
• View Definition
• Data Manipulation
• Integrity Constraints
• Authorisation
• Transaction management operation

6. View Updating Rule – All views that are theoretically updateable must be updateable by the system.

7. Insert and Update Rule – For all Insertion and updation, a single operand must hold good.

8. Physical Independence Rule – When any changes are made in storage, the application programs must remain unimpaired.

9. Logical Data Independence Rule – Changes in data should not affect user's ability to work with the data.

10. Integrity Independence Rule - Integrity constraints should be stored in the system catalog or in the database as a table.

11. Distribution Rule – The system must be able to access or manipulate the data that is distributed in other systems.

12. Non- subversion Rule – Integrity constraints defined by user must not be by-passed by RDBMS.

(b) For developing a scientific codification to take full advantage of it, the following points should be taken care :

i) Uniqueness : Unique code for each separate type of data item.

ii) Convenience : Codes are generally comprised of numerical digits but alphabets may be used in the beginning to have more logical classification. Logic of codification should be simple and easy understandable by the users.

iii) Sub-grouping : Within the code, a group of characters are taken together as sub-code. This is to simplify codification and classification.

iv) Correction mechanism : Sometimes, check digit is also used to ensure accuracy in data entry.

v) Flexibility : Coding system should be flexible enough to ensure smooth incorporation of future modifications and accommodation of possible additional sub-groups due to changes in the system. In other words, future modification should not invalidate code structure.

(c) Major areas of internal control system are discussed hereunder:

• **Separation of duties and responsibilities:** In a conventional system, responsibility is separated for each of the aspects of initiating transactions, recording transactions and maintaining custody of assets in order to prevent or detect errors and irregularities. In a computerized system, this may not be possible in a straight manner. Duty or authority to change program/data may be separated from the point of view of control.

• **Delegation of authority and responsibility:** This is an essential control both under manual and

computer system. In a multi-user database management system, the control problem regarding integrity of data and redundancy of data is minimized. Where more users have authority for developing,modifying, operating and maintaining their application systems instead of by computer professionals, there may be some difficulty in exercising control.

• **Specialist/trained personnel:** If the organisation maintains professionally qualified specialist personnel e.g. System Analyst, Database Administrator, Application Programmer, Computer Operator etc., the control aspect becomes easier to be exercised. Many companies do not maintain such specialists because of high cost of retention. In that case competent and properly trained personnel should be deployed,

as the power vested in the personnel responsible for computer system generally far exceeds the power exercised by the personnel engaged in a manual system.

• **Authorisation system:** Authorisation may be of two types viz. general authorisation (e.g. authority to sell goods at a price as per approved price list) and specific authorisation (purchase proposal requires vetting of the appropriate tender committee depending on type of tender/tender value). While evaluating the adequacy of authorisation procedures, auditor should examine both the work of the related person and the specification of the program processing.

7. (a) State the main goals of E-commerce. [3]
  (b) List the benefits of Electronic Data Interchange. [5]
  (c) State the reasons for accepting ERP system replacing old business system. [5]
  (d) Explain the checks that must be followed to ensure accuracy in input. [5]

Answer:

(a) It helps in achieving following goals
  • Reach new markets.
  • Create new products or services.
  • Build customer loyalty.
  • Enrich human capital.
  • Make the best use of existing and emerging technologies.
  • Achieve market leadership and competitive advantage.

(b) 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.

(c) The reason for accepting ERP System replacing their old business system are as follows:

• Improved business performance through optimum resource utilization
• Reduction in manufacturing cycletime by integrated planning process
• Better support Customers in fast changing in market conditions

- Better Cost Control mechanism by way of accurate costing system
- Enhanced efficiency in control through feedback information and online access to accurate information
- Establishment of Decision Support System etc.

(d) Following are the checks must be followed to ensure accuracy in input:

- **Pre-numbered Source Documents** - Printed source documents with numbers are only documents allowed to prepare source documents to have adequate physical security on the document preparation and to prevent fraud.
- **Input Authentication Check** – to see whether input documents are authenticated by well defined official of user department.
- **Batch Control** – to validate the correctness of important mathematical information of a group of documents with its manual batch total and computer total.
- **Check Digit** – check digit is a redundant digit derived from some mathematical relation out of other digits of the code which is incorporated in the code itself to ensure correctness of code.
- Proper system of verification of data entered in the computer–off-line/on-line.
- **Check List** – detailed list of data entered with indication of logical errors or errors in codes.
- **Parity Check** – a system of adding an extra bit to each character in order to check the possibility of loss of bits during data transfer/transmission to media like tape.

8. (a) Describe Expert System. [5]
   (b) List the salient features of WAN. [4]
   (c) 'Creation for proper environment is essential for effective control system.' -Justify [4]
   (d) Discuss the software tools available for data mining. [5]

Answer:

(a) According to CIMA, an Expert System is an application software system which is used to store data relevant to a particular subject area and to provide solutions to problems requiring discriminatory judgement based on that data.
Expert system is a software which derives extraordinary intelligent solution like an expert. The knowledge of an expert in invaded in the software with solution options for different complex problems situation, particularly, unstructured problem situation. Here the expert knowledge is knowledge of specialized field and solutions sets at different problem situations.
For example, knowledge of expert marketing management for experts system in marketing, knowledge of legal expert for expert system in legal field, expert knowledge of taxation for expert system in taxation.
This expert knowledge and history of different unstructured problem solutions are stored in organized manner so that the related expert system can use the data base. The expert system is not a simple management information system. Rather it helps in involving solutions in complex problem situation. The component in expert systems are
- Data management
- Expert knowledge handling tools
- Complex problem situations and framing corresponding solutions sets.

(b) Following are the salient features of WAN:

- Computing equipment are spread over wide geographical area.

- Communication channels between the machines are from third party like telephone company, satellite channels etc.
- Relatively low capacity communication channels are used.
- Reliability in communication is not fully guaranteed.

(c) Creation for proper environment is essential for effective control system. The two important components there are of great importance-discipline and ethics. Unless these two are enforced no control system can be full proof. Control is done to see that the existing procedure is running smoothly and with comparison with some standard. Performance budget must be prepared honestly. If the budget is vague and substandard, all control measures are futile. Thus creation of environment with professional ethics must be taken care properly. Without proper environment, no amount of deviation from norms get properly checked.

(d) The software tools available for data mining provide the following types of services:

- Neutral computing based on data available to identify potential areas and suggest precautionary measures in the business process
- Intelligent agent's work in retrieving most reliable information
- Support of special expert with necessary IT tools to extract appropriate dataset and use good mathematical model to make predictive solutions
- Optimization of business process variables with Operation Research techniques and guiding business decisions
- Evolving industry standards on many business processes