Paper 9 - Operations Management & Information Systems

Time allowed: 3 hrs **Full Marks: 100**

Section I: Operation Management

Answer Question No. 1 which is compulsory and any Two questions from the rest, under Section I.

Working Notes should form part of the answer.

1. (a) Fill in the blanks with appropriate words: [4]

(i) A jig contains a device for guiding the ----------.

(ii) ---------- is a technique for determining the quantity and timing for the acquisition of dependent demand items needed to satisfy master production schedule requirements

(iii) To evaluate the work done by preventive maintenance,---------- is derived at from the total time of stoppage of the machine for scheduled and unscheduled maintenance work.

(iv) The adoption of JIT normally requires to improve ----------.

(b) Indicate whether the following statements are True/False [4]

(i) Decisions under uncertainty are not always obvious. (True)

(ii) With increase in lot size the set up cost per unit decreases, whereas the inventory carrying cost increases. (True)

(iii) Production Planning & Control techniques include "Machine Loading"(False)

(iv) In general, long range forecasting is more useful in production planning.(False)

(c) What do following abbreviations stand for: [6]

(i) WBS

(ii) COPQ

(iii) FMEA

(iv) ABFS

(v) CPOF

(vi) DNC

Answer 1. (a)

(i) Tool

(ii) Material Requirement Planning

(iii) Down time

(iv) Quality Standard

Answer 1. (b)

(i) True

(ii) True

(iii) False

(iv) False

Answer 1. (c)

(i) **WBS** - Work Breakdown Structure

(ii) **COPQ** - Cost of Poor Quality

(iii) **FMEA** - Failure Mode and Effects Analysis

(iv) **ABFS** - Alternative Basic Feasible Solution

(v) **CPOF** - Capacity Planning Using Overall Factors

(vi) **DNC** - Direct Numerical Control

2. (a) The faculty in an engineering institute is planned to rise to strength of 50 staff members and then to remain at that level. The wastage of recruits depends upon their length of service and is as follows:

Year	1	2	3	4	5	6	7	8	9	10
Total %age who left upto the end of year	5	35	56	65	70	76	80	86	95	100

(i) Find the number of staff members to be recruited every year.

(ii) If there are seven posts of Head of Department for which, length of service is the only criterion of promotion, what will be the average length of service after which a new entrant should expect promotion? [6+4]

(b) A public transport system is experiencing the following number of breakdowns for months over the past 2 years in their new fleet of vehicles:

Number of breakdowns	0	1	2	3	4
Number of months this occurred	2	6	8	5	1

Each breakdown costs the firm an average of ₹2800. For a cost of ₹1500 per month, preventive maintenance can be carried out to limit the breakdowns to an average of one per month. Which policy is suitable for the firm? [5]

(c) Write a note on Problem Formulation under Linear Programming. [3]

Answer 2. (a)

Let us assume that the recruitment per year is 100. From above it is clear that the 100 who join in the first year will become zero in 10th year, the 100 who join in the 2nd year will (serve for 9 years and) become 5 at the end of the 10th tear and the 100 who join in the 3rd year will (serve for 8 years and) become 14 at the end of the 10th year and so on. Thus, when the equilibrium is attained, the distribution length of service of staff members will be as under:

Year	No. of staff members
0	100
1	95
2	65
3	44
4	35
5	30
6	24
7	20
8	14
9	5
10	0
Total	432

(i) Thus if 100 staff members are recruited every year, the total number of staff members after 10 years of service = 432.

To maintain a strength of 50, the number to be recruited every year = $\frac{100}{432} x 50 = 11.6$

It is assumed that those staff members who completed x years service but left before x+1 years' service, actually left immediately before completing x +1 years.

If it is assumed that they left immediately after completing x years' service, the total number will become 432 – 100 = 332 and 100 the required intake will be $= 50 \, x \frac{100}{332} = 15$

In actual practice they may leave at any time in the year so that reasonable number of recruitments per year $= \frac{11.6 + 15}{2}$ =13.3 (approx).

(ii) If we recruit 13 persons every year then we want 7 seniors. Hence if we recruit 100 every year, we shall require $= \frac{7}{13} x 100 = 54$ (approx.) seniors.

It can be seen that 54 seniors will be available if we promote them during 6th year of their service (0 + 5 + 14 + 20 + 24 = 63 > 54.

The promotion of a newly recruited staff member will be due after completing 5 years and before putting in 6 years of service.

Answer 2. (b)

Converting the frequencies to a probability distribution and determining the expected cost/month of breakdowns we get:

No. of breakdowns	Frequency in months	Frequency in per cent	Expected Value
(A)	(B)	(C)	(D)=(C × A)
0	2	2/22 = 0.091	0
1	6	6/22 = 0.273	0.273
2	8	8/22 = 0.364	0.728
3	5	5/22 = 0.227	0.681
4	1	1/22 = 0.045	0.18
Total	22		1.862

Expected Breakdown cost per month: =1.862 × ₹2800 = ₹5214

Preventive maintenance cost per month:

Average cost of one breakdown/month = ₹2800

Maintenance contract cost/month = ₹1500

Total = ₹ (2800 + 1500) = ₹ 4300.

Thus, preventive maintenance policy is suitable for the firm.

Answer 2. (c)

Problem formulation refers to translating the real life problem into a format of mathematical equalities and inequalities that abstracts all the essential elements of the problem. There are three parts of the formation (i) Objective function (ii) A set of constraints and (iii) Non-negativity restriction.

LP problem has got three points:

(i) Objective function: This describes the object of the management in precise and clear terms in quantitative form. To identify the decision variables and assume optimal values.

(ii) A set of constraints: These are the limitations of the management expressed in quantitative form.

(iii) Non-negative restriction: This restriction prescribes that the decision variables should only be zero or positive.

3. (a) A manager has to decide about the number of machines to be purchased. He has three options i.e. purchasing one, or two, or three machines. The data are given below:

Number of machines	Annual Fixed cost (₹)	Corresponding range of output (units)
1	**10,000**	**0 to 400**
2	**12,000**	**401 to 700**
3	**20,000**	**701 to 1000**

Variable cost is ₹ 20 and revenue is ₹ 40 per unit.

(i) Determine the break-even point for each range.

(ii) If projected demand is between 600 and 750 units, how many machines should the manager purchase? [3+4]

(b) Draw the network for the following activities and find critical path and total duration of project:

Activity	Duration (months)	Activity	Duration (months)
1-2	2	4-7	3
1-3	2	5-8	1
1-4	1	6-8	4
2-5	4	7-9	5
3-6	5	8-9	3
3-7	8		

[6]

(c) What are the various factors to be considered for deciding on automation alternatives?[5]

Answer 3. (a)

Let Q = Break-even Point, FC = Fixed Cost, R= Revenue per unit and VC = Variable cost per unit.

Then $Q = \frac{FC}{(R - VC)}$

(i) Let Q1 be the break-even point for one machine option, Q2 for two machine option and Q3 for three machine option.

Then $Q1 = \frac{10000}{(40 - 20)} = \frac{10000}{20} = 500$ units.

$Q2 = \frac{12000}{(40 - 20)} = \frac{12000}{20} = 600$ units.

$Q3 = \frac{20000}{(40 - 20)} = \frac{20000}{20} = 1000$ units.

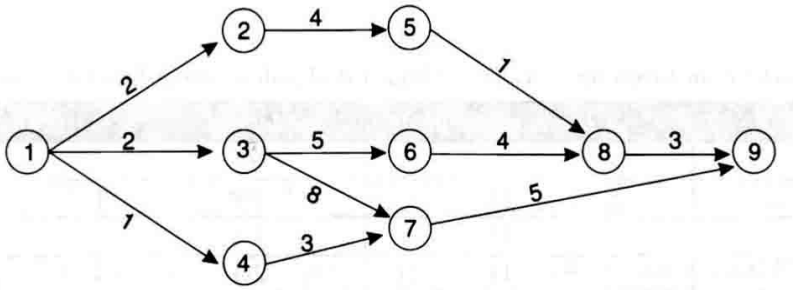
(ii) The break-even point for single machine option (i.e. 500 units) is not feasible because the demand exceeds the range of volume that can be produced with one machine (i.e. 0 to 400 units).

Also, the break-even point for 3 machines is 1000 units which is more than the upper limit of projected demand 600 to 750 units and hence not feasible. For two machines option the break-even volume is 600 units and volume range is 401 to 700.

Hence, the demand of 600 can be met with two machines option which is break-even. If the manager wants to produce 750 units with 3 machines, there will be loss because the break-even volume with three machines is 1000 units.

Hence, the manager would choose 2 machines option.

Answer 3. (b)



Paths	1-2-5-8-9	1-3-6-8-9	1-3-7-9	1-4-7-9
Duration	2+4+1+3 = 10	2 + 5 + 4 + 3 =14	2+8+5 = 15	1+3+5 = 9
The ***critical path is* 1-3-7-9.** Its duration is 15 months.				

Answer 3. (c)

Managers, while considering automation decisions, must evaluate automation alternatives. Economic analysis is an important if not a predominant factor in choosing among automation alternatives. The various factors to be considered are:

(i) **Economic factors:** The focus is on cashflows, annual fixed costs, variable cost per unit, average production cost per unit or total annual production costs at the forecasted production levels. But the main intention is to determine the direct impact of automation on profitability. Break-even-analysis and financial analysis are used for this purpose.

(ii) **Effect on market share:** Some automation alternatives may require product redesign or product specialisation which may affect sales. Even if some alternatives permit more product variety and greater customer appeal, the net effect of such changes on market share is difficult to assess.

(iii) **Effect on product quality:** Impact of automation alternatives on product quality is difficult to measure directly even though scrap rates, market share changes and production costs may reflect the effect of changes in product quality resulting from automation alternatives.

(iv) **Effect on manufacturing flexibility:** Measures of product flexibility and volume flexibility are difficult to develop even though cost of machine change-overs, overtime labour costs and market share changes can be used as measures of the effect of automation alternatives on manufacturing flexibility.

(v) **Effect on labour relations:** The number of workers to be laid off, the amount of training and retraining needed and the availability of skilled workers required to operate automated equipments are factors affecting the choice of automation alternatives

(vi) **The amount of time required for implementation:** Different automation alternatives may require different time durations for implementation because of differences in technology,

availability of competent personnel and different kinds of changes in the rest of production system caused by the automation alternatives.

(vii) Effect of automation implementation on ongoing production: Even while automation projects are being implemented, regular production must go on because delivery of products to customers cannot be postponed. The extent to which the ongoing production gets affected depends on the type of automation alternatives.

(viii) Amount of capital investment required: Availability of capital for inventory in automation project is an important factor to be considered because almost all automation alternatives are highly capital intensive. This factor can be a predominant consideration in automation decisions.

4. (a) The Accounts Manager of Explore Project has studied his varying monthly cash flows and has arrived at the probabilities of cash inflows and outgo as detailed below:

Cash Inflow (₹)	Probabilities	Cash Outgo(₹)	Probabilities
14,000	0.35	11,000	0.15
15,000	0.20	12,000	0.25
16,000	0.15	13,000	0.30
17,000	0.14	14,000	0.15
18,000	0.11	15,000	0.11
19,000	0.05	17,000	0.04

The Manager, at the beginning of the year has ₹2000 in bank.

Simulate his sales and expenses over a financial year (April to March) using the following two series of random numbers.

Assume that the Manager can avail of temporary overdraft facilities to cover any cash shortage.

How much money does the Accounts Manager has at the end of the year?

Series-I: 34, 84, 38, 82, 36, 92, 73, 91, 63, 29, 27, 26

Series-II: 96, 57, 99, 84, 51, 29, 41, 11, 66, 30, 41, 80 **[12]**

(b) What are the factors affecting the process planning? **[3]**

(c) From the following financial data classify the costs as prevention, appraisal, internal failure or external failure.

	(₹)
Sales	10,00,000
Scrap	3,00,000
Rework	4,00,000
Product inspection	1,25,000
Product Warranty	6,00,000
Quality training	80,000

Materials inspection	**40,000**

[3]

Answer 4. (a)

Explore Project

Cash Inflow (₹)	Probabilities	Cumulative probability	Random No. Table
14,000	0.35	0.35	00-34
15,000	0.20	0.55	35-54
16,000	0.15	0.70	55-69
17,000	0.14	0.84	70-83
18,000	0.11	0.95	84-94
19,000	0.05	1.00	95-99

Cash Outgo (₹)	Probabilities	Cumulative probability	Random No. Table
11,000	0.15	0.15	00-14
12,000	0.25	0.40	15-39
13,000	0.30	0.70	40-69
14,000	0.15	0.85	70-84
15,000	0.11	0.96	85-95
17,000	0.04	1.00	96-99

Now using the random no. of series-I for cash inflow and series-II for cash outgo, let us simulate the sales and expenses of the Manager of Explore Project, as per below:

Month	Cash Inflow for the random No. (₹)	Cash Outgo for the random No. (₹)	Net Inflow (₹)	Opening (₹)	Closing Balance (₹)
April	14,000	17,000	-3,000	2,000	-1,000 (overdraft)
May	18,000	13,000	5,000	-1,000	4,000
June	15,000	17,000	-2,000	4,000	2,000
July	17,000	14,000	3,000	2,000	5,000
August	15,000	13,000	2,000	5,000	7,000
September	18,000	12,000	6,000	7,000	13,000
October	17,000	13,000	4,000	13,000	17,000
November	18,000	11,000	7,000	17,000	24,000
December	16,000	13,000	3,000	24,000	27,000
January	14,000	12,000	2,000	27,000	29,000

February	14,000	13,000	1,000	29,000	30,000
March	14,000	14,000	0	30,000	30,000

Thus, at the end of the year, the Accounts Manager will have ₹30,000 cash.

Answer 4. (b)

Factors affecting process planning

- Volume (quantity) of production.
- Delivery dates for components or products.
- Accuracy and process capability of machines.
- The skill and expertise of manpower.
- Material specifications.
- Accuracy requirements of components or parts.

Answer 4. (c)

The classification of different costs is shown as under:

Classification	Nature of Quality Cost	(₹)
Prevention Cost	Quality Training	80,000
Appraisal Cost	Product Inspection	1,25,000
	Material Inspection	40,000
Internal Failure Cost	Scrap	3,00,000
	Re-work	4,00,000
External Failure Cost	Warranty	6,00,000

Section II : Information Systems

Answer Question No. 5 which is compulsory and

Any two questions from the rest.

5. (a) Fill in the blanks with appropriate words: [6]

(i) ---------- is a process of continuous checking of possible encroachment of virus in a machine.

(ii) In Control Unit of CPU, the summation of instruction time and execution time is called ---------- time.

(iii) ---------- is the reverse process to convert the scrambled form of text into readable text.

(iv) A record is identified by its ----------.

(v) ---------- basically sends a mail to the e-mail address of the receiver.

(vi) ---------- is extracting of data from multiple data sources by way of interactive and analytical software tools.

(b) Expand the following abbreviations: [4]

(i) SRAM

(ii) EIS

(iii) GIGO

(iv) CODASYL

(c) Indicate whether the following statements are True/False. [4]

(i) The basic aim of normalization is to ensure that the same data are stored in more than one place.

(ii) DBMS reduces data redundancy.

(iii) In fact, the "effector" is another name for Management Information System.

(iv) Oracle is a programming language.

Answer 5. (a)

(i) Virus Scanning

(ii) Cycle

(iii) Decryption

(iv) key field

(v) Mail Service

(vi) Data Mininng

Answer 5. (b)

(i) **SRAM** – Static Random Access Memory

(ii) **EIS** – Executive Information System.

(iii) **GIGO** – Garbage In Garbage Out

(iv) **CODASYL** – Committee of Conference on Data System Language.

Answer 5. (b)

(i) False

(ii) True

(iii) False

(iv) False

6. (a) ABC Ltd. is considering two options to acquire software for computerizing one of its important functional areas. The options are:

(i) Buying the software package available in the market

(ii) Engaging software industries to design the software [3+3]

(b) Name the different stages of the System Development Life Cycle. [2]

(c) How is a "Computer Virus "different from 'Bug'? Mention the preventive measures needed to ensure that Computer systems are free from Virus. [2+2]

(d) What are the functions of an Operating System? [6]

Answer 6. (a)

The relative advantages and disadvantages of the two options are enumerated in the following table:

	Advantages	Disadvantages
Buying readymade software package	(i) Can be seen and tested.	(i) May not meet requirements fully.
	(ii) Will have fewer bugs	(ii) Enhancement/modifications may be expensive and time consuming.
	(iii) May be less costly	(iii) Requires development, testing and implementation time.
	(iv) Documentation/support facilities.	
Developed by outside software firm	(i) Better control over schedule and cost.	(i) Difficult to negotiate on effort and time required.
	(ii) Does not affect day-to-day operations due to development work.	(ii) Difficult to implement without adequate technical knowledge of the software.
	(iii) Ready skills on chosen hardware or software platforms.	(iii) Difficult to maintain after implementation.
	(iv) Advantage of core	(iv) Unfamiliarity of the outside party about the

	competencies.	business environment may hamper quality
		(v) Maintenance support cost.

Answer 6. (b)

System development involves seven stages. These stages together is called System Development Life Cycle (SLDC). They are:

(i) System Proposal

(ii) System Study

(iii) System design

(iv) Program Development

(v) System Implementation

(vi) System Evaluation & Review

(vii) System Maintenance

Answer 6. (c)

"Virus" is a programme intentionally created to damage/disrupt computers and its systems. It is generally introduced with a computer system as a foreign body.

"Bug" is an unintentional error made while writing a programme. In other words, it is a logical error that has crept into a programme unadvisedly when it is written by a programmer.

Some of the preventive measures which can be undertaken to ensure that the computer systems are free from virus are:

- Using Licensed Softwares.
- Installing "Anti-Virus" for detection and clearing of virus.
- Not to open any e-mail from unknown sources.
- Do not access to dubious sites.

Answer 6. (d)

Following are the functions of the operating system:

- Resource Management means operating system will manage all the resources those are attached to the system like Memory and Processor and all the Input Output devices those are attached to the system are known as the resources of the computer system.
- Memory Management- Operating system also controls all the storage operations means how the data or files will be stored into the computers and how the files will be accessed by the users.
- Device Management involves tracking the status of devices, allocation of various devices to jobs, activate them when needed.
- File Management involves efficient allocation of separate space for each file, arrangement of protection from loss of data etc.
- Interaction with operators- Interpretation of commands from operators, display of error / interruption message etc.

- Security- Function of protecting unauthorized access to system. For this purpose security mechanism through password is followed.

7. (a) What are the salient features of LAN? [4]

(b) What is electronic cash? What are the steps involved in transferring money between parties? [1+4]

(c) Write short note on Search Engines [3]

(d) What are the impediments in introducing E-commerce? [4]

(e) Define Data Mart. [2]

Answer 7. (a)

Salient features of LAN:

(i) Computing equipments are spread over small geographical area.

(ii) Communication channels between the machines are private.

(iii) Server is powerful microcomputer or minicomputer or mainframe.

(iv) LAN file server is a repository of variety of software and data file for the network.

(v) Relatively high capacity communication channels are used.

(vi) More reliable in communication.

(vii) Cost of interfacing is usually low.

Each device in LAN can work independent of network.

Answer 7. (b)

Electronic cash or e-cash or digital money is to provide the means to transfer money between parties in the network.

Steps involved in transferring money between parties are:

(i) Consumer requests his bank to transfer money to e-mint to obtain electronic cash.

(ii) Consumer bank transfers money from customer account to e-mint.

(iii) E-mint sends the cash to consumer. Consumer sends the electronic cash in a hard drive or a small card.

(iv) Consumer selects the goods and transfers the e-cash to merchant.

(v) The merchant provides the goods to the customer.

(vi) The merchant sends the electronic cash to his bank.

(vii) The bank redeems the money from the e-mint.

(viii) E-mint transfers the money to the merchant's bank account.

Answer 7. (c)

Search Engines are websites maintaining databases of websites and their contents. When a user wants to locate particular information, the task is done through a search engine. Searching is

done by index for the database. The web search engine on receiving request from an user, searches the relevant information from the database and submits the information for the user. There are many search engines available on the web.

Some popular search engine are www.google.com, www.rediffmail.com etc. Registration on a search engine is free. Search engine is viewed by millions of people every day. They have become a strong media for advertisement. Search Engine encourages viewers by providing free service.

Answer 7. (d)

The research conducted by many experts on impediments of e-commerce.

Some of them are identified and given as follows:

(i) Security: When an organization uses the internet to engage in e-commerce, it is likely many of its information are exposed to security risk, fraud and abuse. Out of them the most serious is credit card information.

(ii) Legal issues are many like protection against fraud, passing sensitive data to strangers etc.

(iii) Cost of hardware, software and maintenance

(iv) Lack of expertise

(v) Need of training

(vi) Uncertainty of market

Answer 7. (e)

Data Mart is a simple form of data warehousing. In other words. It is a scaled-down version of data warehousing. Data marts of a company are generally created with specific objectives. It may be function specific. The advantages of creation of data mart are low cost and less time requirement. Data marts are created with a specific focus.

8. (a) A company having multiple offices all over India, has decided to install an ERP package for its financial accounting in all offices. The company has considered a centralized architecture in which the database will be stored centrally in the Corporate Office and all offices will access it via VSAT connectivity.

What are the advantages and disadvantages of the architecture? [3+1]

(b) Write a short note on Test Deck. [2]

(c) What is Parity Checking? [3]

(d) The impact of Control System on human behavior can be better explained by Budgetary Control. Explain [6]

(e) What are the features of High Level Languages? [3]

Answer 8. (a)

Advantages of Centralized Architecture:

(i) Hardware setup is less expensive.

(ii) As system provides us all the data related to the entire company,we can fetch any data from a single point at any point of time.

(iii) Consolidated MIS report can be generated much faster.

(iv) Overall control on operations is much compact.

(v) Tampering is not possible as Database administration is centralized.

Disadvantages of Centralized Architecture:

(i) Network setup is very expensive and its maintenance cost is also very high.

(ii) If the network system breaks down then the entire system will be affected.

Answer 8. (b)

Test Deck which is made up of dummy transaction data containing both valid and invalid conditions. These are used to test the effectiveness of programmed controls. The test deck can either be created by the auditor himself on the basis of review carried out or procured from reputed vendors marketing standard software package for the purpose. The processed result can then be compared with the predetermined result to ensure that the programmes are working accurately.

Answer 8. (c)

In order to prevent loss or gain of a bit or data corruption during the process of data transfer within the CPU or between the CPU and computer peripherals, one more bit called the parity check bit is added to the basic code for each character. Thus the number of bits is increased by one e.g. 8 bits in the case of ASCII-7 code, and 9 bits in the case of 8-bit EDCDIC and ASCII-8 codes. There may be odd or even parity convention depending on the computer circuitry designed by the manufacturer and accordingly 0 or 1 is added to make the total number of bits for the character to be odd or even.

Answer 8. (d)

Control system exerts a considerable influence on an individual's behaviour in an organization. The impact of control system on human behavior can be better explained with the aid of examining budgetary control.

(i) Budget Formulation: A bottom-up approach, instead of top-down, involving employees, makes them committed towards meeting the budget.

(ii) Fixing Budgets: Sales, Production and other targets that are determined/fixed are challenging, so as to bring out best out of an individual's efforts.

(iii) Performance Evaluation: This should be done in a constructive manner rather than in a vindictive manner. To ensure proper accountability, an appropriate evaluation with a positive outlook is a necessity.

Budgetary exercise is not simply a tool for planning in control but more importantly a means of achieving coordination between different departments of an enterprise. Cooperation and coordination between employees and the management and among the employees themselves through the budgetary control system i.e. involving all in the process will yield better results.

Answer 8. (e)

The following are the features of High Level Languages:

- They are English like languages and easy to learn.
- Standard sets of words and well defined structures are used.

- Program development effort is less.
- Portability is high.
- It is not machine dependent.