Paper 9- OPERATIONS MANAGEMENT & INFORMATION SYSTEMS

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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 Open System?
(b) Define Product Mix.
(c) Define method of Job Evaluation.
(d) Limitations of Preventive maintenance.
(e) What does Sigma value indicates.
(f) Name any two models of DBMS.
(g) Define Primary Key.
(h) What Kaizen mean?

Answer:

(a) Open System:

(I) An open system is one which interacts with its environment and can changes itself to accommodate the changes in factors like customers performance, price, product design etc.

(II) The adoptability of an open system is judged by its capability in modifying the operational parameters of the system accordingly.

(III) It takes input from outside and exports output to outside.

(IV) For Example, Human body changes as per weather conditions.

(V) If a system accommodate all the changes in the environmental factors as and when required, is said to be perfectly open system.

(b) Production of number of products affects the demonstrated capacity of the process as each product needs setup time. Setup of r a new product might require setting of machines, change in process parameters, and cleaning the facility to change over form the product to another product. A diverse product mix requires many such changes, which reduces the demonstrated capacity.

(c) Job evaluation is a systematic and objective process used by organization to compare the jobs within the organization to determine the relative value or worth or each job. Criteria used in job evaluation can include factors such as education skills, job responsibilities etc.

(d) Limitations of Preventive maintenance:

I. More expensive in the short term and during the initial stages of introduction of preventive maintenance programme.

II. Inspection of plant, equipment and machinery will have to be carefully planned and implemented and improved over a period of time.

(e) The Sigma Value indicates how often defects are likely to occur. The higher the sigma value, the less likely a process will produce defects. As sigma value increases, costs go down, cycle time goes down and customer satisfaction goes up.

(f) Different models of DBMS:

I. Hierarchical database

II. Network database
III. Relational database

(g) Primary key is a set of one or more fields/ columns of a table that uniquely identify a record in database table. It cannot accept null, duplicate values. Only one candidate key can be primary key.

(h) **KAI** means change and **ZEN** means better. Thus KAIZEN means change for the better implies continuous improvement done consistently.

2. Match the following: **[5×1=5]**

List A	List B
(A) Linear Programming	**(i) Product design**
(B) Computer Aided Designing	**(ii) Production control**
(C) Work in process	**(iii) Authentication of electronic record**
(D) Debugging	**(iv) Product mix determination**
(E) Digital Signature	**(v) Syntax error**

Answer:

(A) – (iv)
(B) – (i)
(C) – (ii)
(D) – (v)
(E) – (iii)

3. Statement whether the following statements are True/False: **[5×1=5]**

1. **Private key is used to create a digital signature.**
2. **Online processing and real time processing are same.**
3. **Database Approach increasing redundancy.**
4. **Method study should precede Work Measurement.**
5. **EIS helps top level management is solving unstructured problems.**

Answer:

1. True
2. False
3. False
4. True
5. True

4. Fill in the blanks with one word or two: **[5×1=5]**

(a) Egronomics is another name for _____.
(b) Data which described about another data is _____.
(c) An executive information system is an advanced model of _____.
(d) Efficiency = (_____ / Actual hours) x 100.
(e) A _____ is called on attribute

Answer:

(a) Human engineering
(b) meta data

(c) decision support system
(d) standard hours
(e) header

Section – B

II. Answer any three questions from the following: [15×3=45]

1. (a) Sonar Gold Fields miners at 10th level have an accepted production standard of two trolley-loads an hour in an eight-hour working day. In addition to the mining of the gold-bearing soil, the miners have to do a few routine jobs such as cleaning, sharpening and maintaining the tools, for which they are paid a wage of ₹9 per hour upto a maximum of two hours per day. The base wage rate of the miners engaged in production/mining job is ₹ 6.60 per hour. If Subrata, a miner, produced 18 trolley-loads in addition to performing his routine tasks, what wages should he get at the end of the day? [6]

(b) Following is the data obtained from the Bureau of Industrial Costs and Prices. Have the prices kept pace with the rising costs?

	2007	08	09	10	11	12	13	14	15
Costs per unit of output	203	216	223	239	248	253	279	301	311
Price of final output	225	242	250	271	275	277	295	318	329

[9]

Answer:

(a) Subrato worked for 18 /2 = 9 standard hours on the incentive job.
This is equivalent to a productivity rate of :9 std. hrs 6 hrs. worked = 150%
The 'incentive wages' earned by Subrato are: 150 / 100 x (₹6.60) x (6 hours) = ₹59.40
The 'non-incentive' wages earned by Subrato are: (₹9.00) x (2 hours) = ₹18.00
The total wages to be paid to him are ₹59.40 + ₹18.00 = ₹77.40

(b) Let us call costs as X and prices as Y as shown in the following table:

X	Y	$x = X - \overline{X}$	$y = Y - \overline{Y}$	$x2$	xy	$y2$
203	225	-49.6.	50.8	2460	2520	2581
216	242	-36.6	33.8	1340	1237	1142
223	250	-29.6	25.8	876	764	666
239	271	-13.6	04.8	185	65	23
248	275	-04.6	00.8	21	4	1
253	277	-00.4	1.2	0	0	1
279	295	26.4	19.2	697	507	369
301	318	48.4	42.2	2343	2042	1781
311	329	58.4	53.2	3411	3107	2830
$\sum X = 2273$	$\sum Y = 2482$			$\sum x^2 = 11333$	$\sum xy = 10246$	$\sum y^2 = 939$

$\therefore \overline{X}$ = 252.60 $\therefore \overline{Y}$ = 275.80
For a linear regression, the coefficient of correlation between the variables X and Y is given by:

$$r = \frac{\sum xy}{\sqrt{\sum x^2}\sqrt{y^2}}$$

Where, as already noted, x= $x = X - \overline{X}$ and $y = Y - \overline{Y}$

This is called product-moment formula.

Accordingly.

$$r = \frac{10246}{\sqrt{(11333)(9393)}} = \frac{10246}{10318} = 0.99$$

Therefore, there is a close correlation between costs and prices.

Another Method:

This method uses the relative ranks between the data of each of the variables. The correlation coefficient so obtained is called Rank Correlation Coefficient.

Let us, then, write the X's and Y's in terms of their relative ranks (ranks increase as the values of X or Y increase). The least value of X is given the rank of 1, the next higher value a rank of 2, the next higher to the latter a rank of 3 and so on. The same ranking is done for the variable Y. Refer to the table given below:

	2004	2005	2006	2007	2008	2009	2010	2011	2012
Relative rank of costs, X	1	2	3	4	5	6	1	8	9
Relative rank of prices, Y	1	2	3	4	5	6	1	8	9
Differences in ranks of X and Y, D	0	0	0	0	0	0	0	0	0

Now, the coefficient of rank correlation is given by

$$r_{rank} = 1 - \frac{6\sum D^2}{N(N2-1)}$$

Where N= number of data points.

In the present case, however, $\sum D^2 = 0$. Therefore, $r_{rank} = 1$, which indicates a perfect correlation between the variables.

Since the rank correlation coefficient is based purely on the ranks, it is a more rough estimate of the correlation between the variables.

2. (a) A project consists of six activities. Activities P, Q, R run simultaneously. The relationships among the various activities is as follows:

Activity	Immediate Successor
P	S
Q	T
R	U

Activity T is the last operation of the project and it is also immediate successor to R and S. Draw the network of the project. [7]

(b) Six Salesmen are to be allocated to six sales regions so that the cost of allocation of the job will be minimum. Each salesman is capable of doing the job at different cost in each region the cost matrix is given below:

Region							
		I	II	III	IV	V	VI
Salesmen	A	15	35	0	25	10	45
	B	40	5	45	20	15	20
	C	25	60	10	65	25	10
	D	30	70	40	5	40	50
	F	10	25	30	40	50	15

(I) Find the allocation to give minimum cost what is the cost?

(II) Now suppose the above table gives earning of each salesman at each region. How can you find an allocation so that the earning will be maximum? Determine the solution with optimum earning. Mention any six characteristics of a good Product Design. [8]

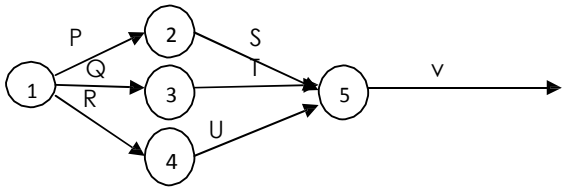
Answer:

(a) Activity immediate successor P S

Q T
R U
S V

T

V
U v
V -



(b) Step – I Row Matrix: Select least value of the each row and then subtract the same from the remaining values in each row

	I	II	III	IV	V	VI
A	15	35	0	25	10	45
B	35	0	40	15	10	15
C	15	50	0	55	15	0
D	15	10	25	0	15	50
E	25	65	35	0	35	45
F	0	15	20	30	40	5

Step – II: Column operation select least value in each and submit the same form values in each column

	I	II	III	IV	V	VI
A	15	35	0	25	0	45
B	35	0	40	15	0	15
C	15	50	0	55	15	0
D	15	10	25	0	5	50
E	25	65	35	0	25	45
F	0	15	20	30	40	5

Step – III: Improvel matrix: First least value in uncovered lines and subtract the same from uncovered lines value. Add to the value at intersect point and unchanged the covered lines values.

3. (a) Standard time for a task is 8 hours. Calculate the efficiency of a workman in the following cases:

(i) worker completes the job in 10 hours.

(ii) worker completes the job in 6 hours. [6]

(b) The data on the operating costs per year and resale prices of equipment A whose

purchase price is ₹10,000 are given here:

Year	1	2	3	4	5	6	7
Operating Cost (₹)	1500	1900	2300	2900	3600	4500	5500
Resale Value (₹)	5000	2500	1250	600	400	400	400

(i) What is the optimum period for replacement?

(ii) When equipment A is 2 years old, equipment B, which is a new model for the same usage, is available. The optimum period for replacement is 4 years with an average cost of ₹3600. Should we change equipment A with that of B? If so, when?

[9]

Answer:

(a) (i) Worker completes have work in 10 hours

$$\text{Efficiency} = \frac{\text{Standard hours}}{\text{Actual hours}}$$

$$= \frac{8 \text{ hours}}{10 \text{ hours}} \times 100 = 80\%$$

(ii) Worker completes the work in 6 hours

$$\text{Efficiency} = \frac{\text{Standard hours}}{\text{Actual hours}}$$

$$= \frac{8 \text{ hours}}{6 \text{ hours}} \times 100 = 133.3\%$$

(b) (i) The determination of the optimal period of replacement of equipment A is given table below:

Table: Determination of Optimal Replacement Period

Year	Mt	Cum Mt	C-S	T (n)	A (n)
1	1500	1500	5000	6500	6500.0
2	1900	3400	7500	10900	5450.0
3	2300	5700	8750	14450	4816.7
4	2900	8600	9400	18000	4500.0
5	3600	12200	9600	21800	4360.0*
6	4500	16700	9600	26300	4383.3
7	5500	22200	9600	31800	4542.9

Since the average cost corresponding to the 5 – yearly period is the least, the optimal period for replacement = 5 years.

(ii) As the minimum average cost for equipment B is smaller than that for equipment A, it is prudent to change the equipment. To decide the time of change, we would determine the cost of keeping the equipment in its 3rd, 4th and 5th year of life and compare each of these values with Rs.3600 (the average cost for equipment B. The equipment A shall be held as long as the marginal cost of holding it would be smaller than the minimum average cost for equipment B. The Calculations are given here:

Year	Operating Cost	Depreciation	Total Cost
3	2300	1250 (= 2500 – 1250)	3550
4	2900	650 (= 1250 – 600)	3550
5	3600	200 (= 600 – 400)	3800

Since the cost incurred in keeping the equipment A in the third and the fourth years is less than the average cost for equipment B, the replacement should be done after 2 years.

4. (a) What are the steps in process planning? [7]

(b) What do you mean by CBA (Cost Benefit Analysis). List the various steps in Cost Benefit Analysis. [8]

Answer:

(a) Steps in Process Planning:

(i) Detailed study of the component drawing to identify the salient features that influence process selection, machine selection, inspection stages and tooling required.
(ii) List the surfaces to be machined.
(iii) The surfaces to be machined are combined into basic operations. This step helps in selection of machines for operation.
(iv) Determine the work centre, tools, cutting tools, jigs and fixtures and inspection stages and equipment.
(v) Determine the speed, feed and depth of cut for each operation.
(vi) Estimate the operation time.
(vii) Find the total time to complete the job taking into account the loading and unloading times, handling times, and other allowances.
(viii) Represent the details on the process sheet.

(b) CBA provides the information to make a sound and balanced business decision about the cost and benefits, or values, of various economic choices (for and investment). It is a methodology for management to use when decisions need to be made among the competing alternatives. It enables the agency to quantify the activities of the existing and alternative processes on monetary and non-monetary basis. When the agency conducts a CBA, it defines its objectives and alternatives in terms of cost and benefits. It also defines important assumptions, factors, and judgments to build the cost and benefits used in comparing alternatives. The final product is a consistent document the enables the agency to understand what costs and what benefits are associated with the various alternatives.

Steps in Cost – Benefit Analysis:

The general steps for performing a CBA are listed below. Using this approach as a framework for developing a CBA will help the agency evaluate its status quo / alternative (as-is / to-be) processes, define objectives more thoroughly and address the alternative consistently. Although the general outline should always be followed, the amount of details used during each step will vary depending on the size and complexity of the individual project.

1. Define the Project: This step is the most critical. It forms the foundation for the rest of the effort. It includes identifying the problem to be solved, the objectives of the mission or function, and the alternatives that will satisfy the customer's needs while staying within the environmental factors, such as assumptions and constraints. It also includes defining the work breakdown structure deliverables to be costed and the assumptions and ground rules for the status quo and alternative models. The WBS becomes the outline for the rest of the work to be done. The WBS will be updated on a regular basis as the analysis progresses.

2. Research the Cost Elements: This step includes researching the cost elements that make up the WBS, collecting appropriate cost-driver data, analyzing and validating the data, deciding on an estimating methodology, and then costing all the elements. The need is to develop future profiles of the current system and the projected profiles of alternative proposed systems.

The process of identifying, development, acquisition, operating costs and benefits is necessary even if formulas and cost elements are not well defined using techniques, such as parametric method, analogy method, bottoms-up engineering method, etc. The total cost of product, taking into account its size, complexity and extent of work, covers all differentiating costs for all elements used for research, design, development, integration, test, acquisition, deployment, management, operation and disposal of modified process or systems.

3. Identify Cost Drivers: Once the basic estimating is done, there is a need to identify the principal functional, technical, and schedule cost drivers and their potential sensitivity to changes in assumptions or project decisions in the preparation for the next steps.

4. Analyse Risk and Sensitivity: Once the costs are calculated for each lifecycle phase, they are then aggregated to show the total lifecycle costs and benefits. Based on this information, the agency will identify the cost-risk items and perform sensitivity analysis to determine whether changes might exceeds the current estimate. The sensitivity analysis tests the impact of risk and uncertainty to determine which conditions might change the ranking of alternatives.

Section – C

III. Answer any two question form the following: [15×2=30]

1. (a) State the main reasons for the spread of E – Commerce. [8]

(b) What are major features of SDLC. [7]

Answer:

(a) Main reason 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 x 7 (24 hours a day, 7 days a week).

(iii) It helps in bringing about positive changes in an organization.

(iv) People are now having a widespread access to IT and Personal Computer (PCs).

(v) E-commerce helps in reducing operating costs and increasing profit margins due to global operations.

(vi) Demand for customized products and services are increasing.

(b) The process of system development starts when management or sometimes system development personnel realize that a particular business system needs improvement. The system Development Life Cycle (SDLC) consists of a set of phases/activities in which each phase of the SDLC uses the results of the previous one.

The system development life cycle method consists of the following activities:

(a) Preliminary investigation: Users submit a formal request for a new system to the MIS department, when they come across a problem. This activity consists of three parts –

(i) Request clarification
(ii) Feasibility study
(iii) Request approval

(b) Requirements analysis or systems analysis: Several fact-finding techniques and tools such as questionnaires, interviews, observing decision-maker behaviour and office environment, etc. are used for understanding the requirements of the users. As details are gathered, the analysts study the present system to identify its problems and short comings and identify the features which the new system should include to satisfy a new or changed user application environment.

(c) Design of the system: The analyst designs various reports/outputs, data entry procedures, inputs, files and database. These detailed design specifications are then passed on to the programming staff for software development.

(d) Acquisition and development of software: Specific type of hardware, software and services are determined. Subsequently, choices are made regarding which products to buy or ideas from which vendors. Software developers then install purchased software or they may write new custom designed programs.

(e) System testing: Special test data are input for processing, and then the results are examined. Various types of testing is made such as Unit testing, Integration testing, System testing etc.

(f) Implementation and maintenance: Implementation and Maintenance is the final stage in SDLC. When system is found to be fit, it is implemented. After implementation, the system is maintained and it is modified to adapt to changing users and business needs.

2. (a) Explain characteristics of an information system [8]

(b) What are the basic features of an MIS? [7]

Answer:

(a) The general characteristics of an information system are:

1. **Specific Objective:**
   - The information system should have some specific objective.
   - An information system, in highly scientific research centre, will have an objective to accumulate data from different activities, display of some information instantly for controlling activities and so on.
   - A system without object is useless.
2. **Structured:**
   - The structure of the information system refers to diagrammatic representing of the system showing sub-systems, their inter-relation and the procedure to be followed to fulfill the process requirements.

- An information system should have a definite structure with all modules of sub-systems.
- The structure depends on the sub-models, their interactions and integration requirements, operational procedure to be followed and the solution sets.

3. **Components:**
   - The sub-systems are the components.
   - The sub-systems should be distinguishable among themselves but have well-defined relation among them.
   - For example, a sales system may be sub-systems like invoicing, delivery monitoring, and sales proceeds collection system.
4. **Integrated:**
   - An information system should be designed in such a fashion that proper integration among sub-systems ae taken care to establish correct linkage and generate meaningful information.
   - Information in isolation may not be that meaningful but its usage is improved if it is integrated with information of other closely related issues.
   - For example, sales information of a region becomes more meaningful if other information combined in the information set.
5. **Life-Cycle:**
   - An information system will have its own life-cycle.
   - The duration of life cycle varies from system to system.
   - Every information system will have distinctly different phases – Initial, Growth, Maturity and Decline.
6. **Behavior:**
   - A system has its own set of reactions and the outcome depends on its environment.
   - A well managed business information system behaves nicely with its users by satisfying them with correct and timely information.
   - The design of the system plays a good role in setting its behavior pattern.
7. **Self – Regulatory**
   - An information system which may have different sub-systems interacting with the each other in a desired fashion to be operative smoothly and in the process they regulate themselves. This is what self-regularly nature of the system.

(b) Basic features of MIS

i. Management oriented – It means the effort for development of the information system should start from and appraisal of management needs and overall business objectives.

ii. Integrated – Development of Information should be an integrated one,. It means all the functional and operational information sub – System should be tied together into one entity.

iii. Reliability – MIS system should provide most reliable information. A thorough check of input information, process follow and output reports on regular and routine basis.

iv. Flexibility – MIS should be flexible enough to take care of changes in the environment in the business system.

v. Consistency – The input data and output reports must follow some standard norms so that consistency is preserved.

vi. Timeliness – One of the most important issues involved in the effectiveness of MIS are flow of information right rime to the user level of management.

vii. Relevance – Only relevant information should flow at different levels of management to increase the effectiveness of MIS.

viii. Simplicity – An MIS system should be as simple as possible so that people at operation and users do not feel any hazards. The success of a system lies in the acceptance by operation staff and users.

3. (a) Explain various SET operators used in DBMS. [7]

(b) State two distinctive features of each of the following technologies used in a business situation: [2×4=8]

(i) Management Information System

(ii) Decision Support System

(iii) Executive Information System

(iv) Expert Systems.

Answer:

(a) Union Operator (U):

The union operator is denoted by the word UNION or the symbol U. It is used to combine the result-set of two or more SQL statements.

Relation X	
Batch – No	Course
1	BA
2	BSC
3	BCA
4	BCOM

Relation Y	
Batch – No	Course
1	BA
2	BSC
3	BCA
4	BCOM
5	MA
6	MSC

(X U Y)	
Batch – No	Course
1	BA
2	BSC
3	BCA
4	BCOM
5	MA
6	MSC

Intersect Operators:

The intersection operator is denoted by the word INTERESECT or the symbol ∩
The INTERSECT operator takes the results of two statements/ quires and returns only rows that appear in both result sets. The intersect operator removes duplicate rows from the final result set.

Relation X

REGN – No	NAME	Occupation
ABC 123	AMAL	SERVICE
ABC 124	KAMAL	STUDENT
ABC 125	BMAL	STUDENT
ABC 129	RITA	SERVICE
ABC 130	SITA	BUSINESS

ABC 131	GITA	STUDENT

Relation Y

REGN – No	NAME	Occupation
ABC 124	KAMAL	STUDENT
ABC 125	BIAMAL	STUDENT
ABC 131	GITA	STUDENT
ABC 234	MITA	STUDENT
ABC 235	SUMITRA	STUDENT
ABC 236	SUCHITRA	STUDENT

ABC 124	KAMAL	STUDENT
ABC 125	BIMAL	STUDENT
ABC 131	GITA	STUDENT

The extended Cartesian produce of two relations is denoted by operator ¥ and it products a third relation containing all possible tuples that may be formed by concatenating the attributes of the relations. At last it gives M*N records in the result Let:

Relation A	Relation B
Names	Hobbies
Amal	Black collection
Kamal	Stamp
Bimal	Coin collection

The A¥B yields the following relation

Relation A¥B	
Amal	Block collection
Amal	Stamp
Amal	Coin collection
Kamal	Block collection
Kamal	Stamp
Kamal	Coin collection
Bimal	Block
Bimal	Stamp
Bimal	Coin collection

(b) Two distinctive features of each of the following terms are mentioned below:

I. Management Information System:

(A) It meets information requirement at different levels with pre-defined reports.

(B) It supports routine decision making.

II. Decision Support System:

(A) It is based on one or more corporate databases.

(B) It is used for solution in a complex business situation.

III. Executive Information System:

(A) It aims at providing information to top executives of an organization who are involved in strategic decision making.

(B) It is an advanced model of Decision Support System which can take care of unstructured problem situation.

IV. Expert System:

(A) It is a knowledge based system which acts as an expert in devising solutions.

(B) It operates on previous experience which is stored in a database.