Paper 9 – OPERATIONS MANAGEMENT & STRATEGIC MANAGEMENT

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

The figures in the margin on the right side indicate full marks.
This question paper has two sections.
Both the sections are to be answered subject to instructions given against each.

Section – A

I. Answer the following questions which is compulsory:

1. Answer any five of the following questions: [5×2=10]
(a) Define efficiency
(b) List the application of PERT
(c) Define Quality Circle
(d) What is meta-data?
(e) Define entropy.
(f) Mention any two reasons for spread of e-commerce.
(g) What is iconic scale model?

Answer:

1. (a) Efficiency refers to how well the resources are brought together for achieving results with minimum costs. It implies the attainment of a level or range of result that is acceptable but not necessarily desirable.

$$\text{Efficiency} = \frac{\text{Actual}}{\text{Standard output}} \text{ (or) efficiency} = \frac{\text{Standard Hours Produced}}{\text{Actual Hours}}$$

(b) 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.

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

(d) 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 catalog, which contains various information. The information stored in the catalog is called meta-data, and it describes the structure of the primary database.

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

System	Maintenance of Entropy	Negative Entropy
Automobile	Engine won't start, tyres too thin	Tune up engine, replace tires
Computer program	User dissatisfaction with features and errors	Program enhancements

(f) 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).

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

2. Match the following: **[5×1=5]**

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

Answer:

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

3. Statement whether the following statements are True/False:
(a) C++ is a programming language.
(b) Critical path is the shortest path from beginning of the project to ending of the project.
(c) An open system is a self contained one and normally a rigid one.
(d) Memory is used to store data, program and results.
(e) Industrial Engineering is a staff function.

Answer:

3. (a) True
   (b) False
   (c) False
   (d) True
   (e) False

4. Fill in the blanks with one word or two:
(a) Efficiency = (_____ / actual hours) x 100.
(b) Processed data is known as _____.
(c) Database management is responsibility of _____.
(d) _____ is a single purpose machine tools designed for cutting gears.
(e) Expand MTBF _____.

Answer:

4. (a) Standard hours;
   (b) Information;
   (c) DBA;
   (d) Hobbing machine;
   (e) Meantime between failures.

SECTION – B

II. Answer any three questions from the following:

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

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

Compute the standard time for the job.

(b) A plant Manager is considering replacement policy to a new machine. He estimates the following costs

Year	**1**	**2**	**3**	**4**	**5**	**6**
Replacement cost at the beginning of the year	**100**	**110**	**125**	**140**	**160**	**190**
Salvage values at the end of the year	**60**	**50**	**40**	**25**	**10**	**0**
Operating Costs	**25**	**30**	**40**	**50**	**65**	**80**

Find the year when replacement is to be made.

Answer:

1. (a) (1) Overall time per unit (To) = (Duration of study/Number of jobs produced during study) = (120 x 60) / 800 = 9 min.

(2) Effective time per piece (Te) = T0 × (Production observation/ Total observation) = 9 × (5800 /7000) = 7.46 min.

The effective time is to be segregated into manual time and machine element time. Machine controlled time per piece (Tm) = 7.46 × 1/4 = 1.87 min
Hand controlled time per piece (Th) = 7.46 × 3/4 = 5.59 min
Normal time per piece = Tm + Th × performance rating = 1.87 + 5.59 × 1.2 = 8.58 min.
Standard time per piece = 8.58 (1 + 0.17) = 10.04 minutes.

(b) Chart showing optimal replacement

Year	Net capital cost (₹)	Operating Cost (₹)	Cumulative operating	Total cost	Average cost
1	40	25	25	65	65
2	60	30	55	115	57.5
3	85	40	95	180	60
4	115	50	145	260	65
5	150	65	210	360	72
6	190	80	290	480	80

Optimal replacement is the end of 2nd year.

2. (a) XYZ manufacturing company planning to start its production activities has to decide on the location of the plant. Three locations are being considered:

	Location A	**Location B**	**Location C**
Fixed costs (₹ Lakhs per annum)	**35**	**55**	**30**
Variable cost (₹ Per annum)	**350**	**250**	**400**

The expected sales price of the product is ₹750 per unit. Find out:

(A) The range of annual production/sales volume for which each location is most suitable, and

(B) Which one of the three is the best location at the production/sales volume of 22,000 units? Clearly mention the assumptions, if any.

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

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

Use the following sequence of random numbers to simulate the demand for next 10 days.
Also find out the average demand per day
Random Numbers: 25, 39, 65, 76, 12, 05, 73, 89, 19, 49.

Answer:

2. (a)

Total costs at the three locations = Fixed costs + Variable costs for a volume of 'X'
At Location A : TCA = 35,00,000 + 350X
At Location B : TCB = 55,00,000 + 250X
At Location C : TCC = 30,00,000 + 400X
Assumptions : Let us assume Production Volume of 5,000; 10,000; 15,000; 20,000; and 25,000 units and also for 22,000 units as specified in the problem.

Volume	Location A					
	5,000 Units	10,000 Units	15,000 units	20,000 units	25,000 units	22,000 units
Fixed costs (₹)	35,00,000	35,00,000	35,00,000	35,00,000	35,00,000	35,00,000
Variable costs (₹)	350 ×5,000 =17,50,000	350 × 10,000 = 35,00,000	350 ×15,000 = 52,50,000	350 × 20,000 = 70,00,000	350 × 25,000 = 87,50,000	350 × 22,000 = 77,00,000
Total costs (₹)	52,50,000	70,00,000	87,50,000	105,00,000	122,50,000	112,00,000

Volume	Location B					
	5,000 Units	10,000 Units	15,000 units	20,000 units	25,000 units	22,000 units
Fixed costs (₹)	55,00,000	55,00,000	55,00,000	55,00,000	55,00,000	55,00,000
Variable costs (₹)	250 × 5,000 =12,50,000	250 ×10,000 = 25,00,000	250 ×15,000 = 37,50,000	250 × 20,000 = 50,00,000	250 × 25,000 = 62,50,000	250 × 22,000 = 55,00,000
Total costs (₹)	67,50,000	80,00,000	92,50,000	105,00,000	117,50,000	110,00,000

Volume	Location C					
	5,000 Units	10,000 Units	15,000 units	20,000 units	25,000 units	22,000 units
Fixed costs (₹)	30,00,000	30,00,000	30,00,000	30,00,000	30,00,000	30,00,000
Variable costs (₹)	400 × 5,000 = 20,00,000	400 ×10,000 = 40,00,000	400 ×15,000 = 60,00,000	400 × 20,000 = 80,00,000	400 × 25,000 = 100,00,000	400 × 22,000 = 88,00,000
Total costs (₹)	50,00,000	70,00,000	90,00,000	110,00,000	130,00,000	118,00,000

(A) The range of annual production/sales volume for which each location is most suitable, as evident from the above tables, may be derived as under –

- Upto 10,000 units: Location C
- Between 10,000 and 20,000 units: Location A
- Above 20,000 units: Location B

(B) For 22,000 units, Location B is preferred

(b) Computation of random numbers rage:

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

Simulation the demand for next 10

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

Average demand = 240/10=24 days

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

(b) From the following time series data of sale project the sales for the next three years.

Year	2009	2010	2011	2012	2013	2014	2015
Sales ('000 units)	80	90	92	83	94	99	92

Project the trend values for 2016, 2017 and 2018.

Answer:

3. (a) The Eight Most Common Benchmarking Errors:

1. Lack of Self-Knowledge: Unless own operations are thoroughly analysed, the benchmarking efforts will not pay off. One has to know how things work in a company, how effective current processes are, and what factors are critical. That's why internal benchmarking is an important first step.
2. Benchmarking everything: Be selective. Benchmarking another company's employee food service will usually not be worth the time, energy, and cost. Own TQM effort as a whole will point out the areas where benchmarking is most likely to pay off.
3. Benchmarking projects are broad instead of being focused. The more specific the project, the easier it is and the more likely it will generate useful ideas. Benchmark a successful company's hiring procedures, not their entire human resources operations. Focus on accounts receivable handling, not the accounting department as a whole.
4. Benchmarking produces reports, not action. Studies have indicated that 50% of

benchmarking projects result in no specific changes. The process is not an academic exercise. It should be geared toward generating and implementing actual changes.

5. Benchmarking is not continuous. Benchmarking is a process. Even before one reaches the benchmark one has set, one should take another look at partner's performance, or at other companies. New goals should be established and new techniques adopted. The process never ends.
6. Looking at the numbers, not the issues. While the measures are important, they are not the heart of the process. At some companies, benchmarking is used to set goals, but not to generate the important changes needed to meet them.
7. Participants are not motivated. Make sure benchmarking team members have the time to do the job. Even if the project is simply added on their regular jobs, make sure each has a stake in the success of the project. Benchmarking should not be considered as "busy work" to be assigned to a group of low-level employees.
8. Too much data. Action is what's important, not information for its own sake. Benchmarking success should not be considered by quantity of information. It is necessary to always focus on key issues.

(b) Computation of trade value

Year	Time deviation (X)	Sales (Y) ('000 units)	x^2	xy
2009	-3	80	9	-240
2010	-2	90	4	-180
2011	-1	92	1	-92
2012	0	83	0	0
2013	1	94	1	94
2014	2	99	4	198
2015	3	92	9	276
	$\sum x=0$	$\sum y=630$	$\sum x^2=28$	$\sum xy=56$

Regression equation of Y on X

Y = a+b.x

$$A = \frac{\sum y}{\sum n} = \frac{630}{7} = 90$$

$$B = \frac{\sum xy}{\sum x^2} = \frac{56}{28} = 2$$

Project trend values for

Y 2016 = 90 + 2x4 = 98

Y 2017 = 90 + 2x5 =100

Y 2018 = 90 + 2x6 =102

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

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

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

(b) What are the objectives of maintenance management?

Answer:

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

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

(ii) Annual production capacity of one machine in standard hours = 8 × 288 = 2,304 hours per year.

(iii) Number of machines required = Work load per year/Production capacity per Machine = 6,725 / 2,304 = 2.92 machines = 3 machines.

(b) (1) Minimizing the loss of productive time because of equipment failure (i.e., minimizing idle time of equipment due to break down).
(2) Minimizing the repair time and repair cost.
(3) Minimizing the loss due to production stoppages.
(4) Efficient use of maintenance personnel and equipments.
(5) Prolonging the life of capital assets by minimizing the rate of wear and tear.
(6) To keep all productive assets in good working condition.
(7) To maximize efficiency and economy in production through optimum use of facilities.
(8) To minimize accidents through regular inspection and repair of safety devices.
(9) To minimize the total maintenance cost which includes the cost of repair, cost of preventive maintenance and inventory carrying costs due to spare parts inventory.
(10) To improve the quality of products and to improve productivity.

Section – C

1. (a) Discuss about Prerequisite of an effective MIS.
(b) List the tangible benefits of ERP.
(c) What are the benefits and limitations of using flow charts?

Answer:

1. (a) The following are pre-requisites of an effective MIS:

- **Database** - The data in database is organised in such a way that access to the data is improved and redundancy is reduced. Such a database is capable of meeting information requirements of its executives, which is necessary for planning, organising and controlling the operations of the business.
- **Qualified System and Management Staff** - MIS should be managed by qualified officers. The organizational management base should comprise of two categories of officers (i) System and Computer experts and (ii) Management experts
- **Support of Top Management -** An MIS becomes effective only if it receives the full support of top management. To gain the support of top management, the officer should place before them all the supporting facts and state clearly the benefits which will accrue from it to the organization.
- **Control and Maintenance of MIS -** Sometimes users develop their own procedures or shortcut methods to use the system, which reduces its

effectiveness. Maintenance is closely related to control

(b) Tangibles benefits of ERP:

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

(c) Benefits of Flowchart

- **Communication:** Flowcharts are better way of communicating the logic of a system and easily understandable.
- **Effective analysis:** With the help of flowchart, problem can be analyzed in more effective way.
- **Proper documentation:** Program flowcharts serve as a good program documentation.
- **Efficient Coding:** The flowcharts act as a guide during the systems analysis and program development phase.
- **Proper Debugging:** The flowchart helps in debugging process.
- **Efficient Program Maintenance:** The maintenance of operating program becomes easy with the help of flowchart. It helps the programmer to put efforts more efficiently on that part.

Limitations of Using Flowcharts

- **Complex logic:** Sometimes, the program logic is quite complicated. In that case, flowchart becomes complex.
- **Alterations and Modifications:** If alterations are required, the flowchart may require redrawing completely.
- **Reproduction:** As the flowchart symbols cannot be typed, reproduction of flowchart becomes a problem.

2. (a) Define EIS and List the special features of and EIS.
(b) Explain various SET operators used in DBMS.

Answer:

2. (a) An Executive Information System (EIS) is special type MIS meant for top management of an organization. In other words, it is a Decision Support System (DSS) for Executives. Executive decisions are of three types – strategic planning, tactical planning and 'fire-fighting'.

According to CIMA: An Executive Information System (EIS) is a set of procedure designed to allow senior managers to gather and evaluate information relating to the organization and its environment.

Following are the special features of an EIS:

- It is a specially designed tool to feed executives information need.
- It is an easy - to - use and screen based software.
- It provides the executives the facilities of on-line analysis tools like time series analysis, regression analysis etc.
- It is not limited to internal data only. Access to external sources of data is also

provided.
- It provides the facilities to connect to internet.
- Information is presented in summary format.
- It is a comprehensive Information System and work in conjunction with DSS.

(b) **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			Relation Y	
Batch – No	Course		Batch – No	Course
1	BA		1	BA
2	BSC		2	BSC
3	BCA		3	BCA
4	BCOM		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	BIAMAL	STUDENT
ABC 131	GITA	STUDENT

Extended Cartesian product: 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 COLLECTION
BIMAL	COIN COLLECTION

The A¥B yields the following relation

Relation A¥B	
AMAL	Block collection
AMAL	Stamp collection
AMAL	Coin collection
KAMAL	Block collection
KAMAL	Stamp collection
KAMAL	Coin collection
BIMAL	Block collection
BIMAL	Stamp collection
BIMAL	Coin collection

3. (a) List the advantages & disadvantages in E- commerce.
(b) Explain different types of database backups.

Answer:

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

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

(b) Different types of database backups are given as follows:
- **On-line backup:** It is performed by executing the command-line or from the "Backup database" utility. When an on-line backup process begins, the database engine externalizes all cached data pages kept in memory to the database file on disk. This process is called a check point. The database engine continues recording activity in the transaction log file while the database is being backed up. The log file is backed up after the backup utility finishes backing up the database. The log file contains all of the transactions recorded since the last

database backup. For this reason the log file from an on-line full backup must be applied to the database during recovery.

- **Live backup:** A live backup is carried out by using the BACKUP utility with the command-line option. A live backup provides a redundant copy of the transaction log for restart of the system on a secondary machine in the event the primary database server machine becomes unusable.
- **Full database backup:** For a full backup, the database backup utility copies the database and log. A full backup capture all files on the disk or within the folder selected for backup. With a full backup system, every backup generation contains every file in the backup set.
- **Incremental Backup:** An incremental backup uses the DBBACKUP utility to copy the transaction log file since the most recent full backup. When we perform an incremental backup, the mirror log is not backed up. When we backup and renamed the log files, the transaction and mirror logs file are renamed and a new log files are created. One must plan to manually backup the mirror log.