PAPER 9 - OPERATIONS MANAGEMENT & INFORMATION SYSTEM

The following table lists the learning objectives and the verbs that appear in the syllabus learning aims and examination questions:

	Learning objectives	Verbs used	Definition
LEVEL B	KNOWLEDGE What you are expected to know	List	Make a list of
		State	Express, fully or clearly, the details/facts
		Define	Give the exact meaning of
	COMPREHENSION What you are expected to understand	Describe	Communicate the key features of
		Distinguish	Highlight the differences between
		Explain	Make clear or intelligible/ state the meaning or purpose of
		Identity	Recognize, establish or select after consideration
		Illustrate	Use an example to describe or explain something
	APPLICATION How you are expected to apply your knowledge	Apply	Put to practical use
		Calculate	Ascertain or reckon mathematically
		Demonstrate	Prove with certainty or exhibit by practical means
		Prepare	Make or get ready for use
		Reconcile	Make or prove consistent/ compatible
		Solve	Find an answer to
		Tabulate	Arrange in a table
	ANALYSIS How you are expected to analyse the detail of what you have learned	Analyse	Examine in detail the structure of
		Categorise	Place into a defined class or division
		Compare and contrast	Show the similarities and/or differences between
		Construct	Build up or compile
		Prioritise	Place in order of priority or sequence for action
		Produce	Create or bring into existence

Paper – 9 – Operations Management & Information Systems

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

This paper contains 3 questions. All questions are compulsory, subject to instruction provided against each question. All workings must form part of your answer. Assumptions, if any, must be clearly indicted.

Question No. 1 : Answer all questions. [20 marks]

1.

(i) State the meaning of Concurrent Engineering.

(ii) Explain the term Route Sheet.

(iii) A worker is employed for 12 hours. During this period he takes 8 hours to complete a job with the standard time of 7 hours. Calculate the productivity of the workers as a percentage.

(iv) A steel plant has a designed capacity of 50,000 tons of steel per day, effective capacity of 40,000 tons of steel per day and an actual output of 36,000 tons of steel per day. Compute the efficiency of the plant and its utilisation.

(v) List the three axioms of Deming's Triangle.

(vi) State the three prominent kinds of failure probability distribution.

(vii) Define the term Rescue maintenance .

(viii) Define Non-planned or non-structure decisions.

(ix) Describe Encumbrance Budgetary Control.

(x) Define Computer network.

[10×2=20]

Answer:

1.

(i) Concurrent engineering means bringing design and manufacturing people together early in the design phase to simultaneously develop the product and processes for manufacturing the product. Recently this concept has been enlarged to include manufacturing personnel, design personnel, marketing and purchasing personnel in loosely integrated cross-functional teams. In addition, the views of suppliers and customers are also sought frequently. This will result in product designs that will reflect customer wants as well as manufacturing capabilities in the design stage itself.

(ii) A route sheet is a document providing information and instructions for converting the raw materials into finished parts or products. It defines each step of the production operation and lays down the precise path or route through which the product will flow during the conversion process.

(iii) Productivity = Efficiency × Utilization

$$\text{Efficiency} = \frac{\text{Standard time allowed}}{\text{Actual hours used}} = \frac{7}{8}\times 100 = 87.5\%$$

$$\text{Utilization} = \frac{\text{Actual time worked}}{\text{Hours available}} = \frac{8}{12}\times 100 = 66.67\%$$

Productivity = Efficiency × Utilization

= 87.5% × 66.67% = 58.33%

Also Productivity $= \frac{\text{Standardhours of output}}{\text{Clock time scheduled}}$

$= \frac{7}{12} \times 100 = 58.33\%$

(iv) Efficiency of the plant = Actual output/ Effective Capacity
= 36,000/40,000 × 100 = 90%

Utilisation = Actual output/ Design Capacity

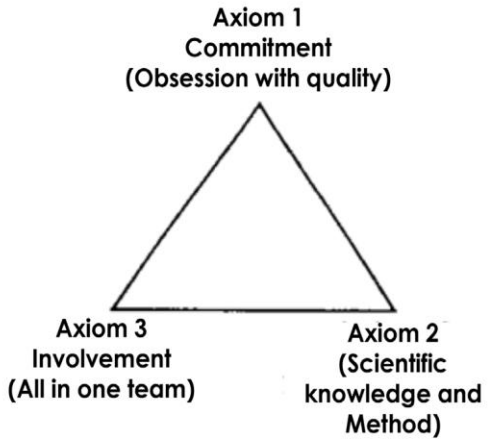
= 36,000 / 50,000 × 100 = 72%

(v) Deming's Triangle (3 axioms):

Axiom 1 : Commitment (Obsession with quality)

Axiom 2 : (Scientific Knowledge & Method)

Axiom 3 : Involvement (All in one team)



(vi) The phenomenon of breakdown or failure is very important in Maintenance Management. A vital information in this regard relates to Failure Statistics. An important statistic is the relative frequency of failure or probability density of failure with respect to the age of the item in question. It has been observed that there are three prominent kinds of failure probability distribution:

(a) Normal Distribution

(b) Negative exponential Distribution

(c) Hyper-exponential Distribution

(vii) Rescue maintenance

Rescue maintenance refers to previously undetected malfunctions or such sudden changes that were not anticipated but require immediate solution. Rescue maintenance is unplanned. Thus a system that is properly developed and tested should have few occasions of rescue maintenance.

(viii) Non-planned or non-structure decisions

Made on problem situations which are non-repetitive, unique. Not much information available. Decisions made by reference intuition and experience. No single best way of making decisions. Solution tend to be unique and unusal. Judgement & discretion is crutial.

(ix) Encumbrance Budgetary control

This functionality, which enables recording of pre expenditure in the form of commitment, is important particularly for government/ public sector, where budgetary control is a statutory requirement. The system creates encumbrances from a requisition, purchase order or a work order, where related amount is needed to be paid in near future. The committed amount is automatically blocked and is not available for other transactions. When the payment is finally made, the encumbrance is relieved, after the account is debited with paid amount.

(x) Computer network – The interconnection of one or more, computers through

(i) The use of satellite, microwave, terrestrial line or other communication media and

(ii) Terminals or a complex consisting of two or more interconnected computers whether or not the interconnection is continuously maintained.

Operations Management

Answer any three questions

2. (a) (i) List the basic types of production control. [6]

(ii) Methods P and Q are both capable of manufacturing a product. They compare as follows:

Data		Method P	Method Q
Fixture	**- cost**	**₹24,000**	**₹16,000**
	- life	**6 months**	**4 months**
Tooling	**- cost**	**₹2,560**	**₹4,800**
	- life	**300 pieces**	**500 pieces**
Processing time per piece		**6 mts.**	**4 mts.**

The annual requirement is 1,500 nos. Operating cost per hour of the process is ₹128 for both processes. Material cost is same in each case.
Which method would you choose for production during a period of one year? [6]

(iii) Write the distinction between method & work study. [4]

Answer:

2. (a) (i) Production control can be of six types:

I. Block control

This type of control is most prominent in textiles and book and magazine printing.

II. Flow control

This type of control is commonly applied in industries like chemicals, petroleum, glass, and some areas of food manufacturing and processing.

III. Load control

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

IV. Order control

This type of control is commonly employed in companies with intermittent production systems, the so-called job-lot shops.

V. Special project control

Special production control is necessary in certain projects like the construction of bridges, office buildings, schools, colleges, universities, hospitals and any other construction industries.

VI. Batch control

Batch control is another important type of production control which is frequently found in the food processing industries.

(ii)

Data	Method P	Method Q
Cost of manufacture per year:		
Fixture cost	₹ 24,000 × 2 = ₹ 48,000	₹ 16,000 × 3 = ₹ 48,000
(2 nos of fixtures are required per year in method P and 3 nos required in method Q)		
Tooling cost	2,560 × 1,500 /300 = 2,560 × 5 = ₹12,800	4,800 × 1500/ 500 = 4800 × 3 = ₹14,400
Operating hours to produce 1,500 nos.	1,500 × 6/60 =150 hrs	1,500 × 4/60 =100 hrs
Operating cost per year	₹128 × 150 = ₹19,200	₹128 × 100 = ₹12,800
Total manufacturing cost per year	₹48,000 + ₹12,800 + ₹19,200 = ₹ 80,000	₹48,000 + ₹14,400 + ₹12,800 = ₹ 75,200

Since method Q is cheaper than method P, method 'Q' is the choice for production during the whole one year period .

(iii) Method study and work measurement are closely linked. Method study is concerned with reduction of work content while work measurement is concerned with the investigation and reduction of the ineffective time and the subsequent establishment of time standards for the task or job or operation on the basis of the work content established by method study. Usually method study should precede work measurement. However, when time-standards for output are being set, it is often necessary to use an appropriate work-measurement technique such as activity sampling (also known as work sampling) in order to determine the ineffective time or idle time. This will facilitate corrective action to be taken by management before going for method study. On the other hand, time study may be used to compare the effectiveness of alternative work methods or operations.

2. (b) (i) A retailer is evaluating two alternative computerized cash register system. The firm expects that about 2,500 customers per hour will require service and estimates a cost of ₹2 per hour per customer in ill will caused by waiting to complete a transaction. Each of the two systems can be considered to be single queue, single server system:

System 1	System 2
= 2,800 per hour	= 3,500 per hour
Operating cost = ₹100/hour	Operating cost = ₹125/hour

Which system would you recommend? [3]

(ii) At a service station a study was made over a period of 50 days to determine both the number of automobiles being brought in for service and the number of automobiles serviced. The results are given below:

No. of automobiles arriving for service or completing services/day	Frequency of arrivals	Frequency of daily serviced
0	4	6
1	8	4
2	20	24
3	10	6
4	6	8
5	2	2

Simulate the arrival service pattern for a ten day period and estimate the mean number of automobiles that remain in service for more than a day.

Use the following series of random numbers:

For Arrivals	09	54	42	01	80	06	06	26	57	79
For Service	49	16	36	76	68	91	97	85	56	84

[7]

(iii) Explain the need for Productivity Improvement. [6]

Answer:

2. (b) (i) For system 1:

λ = 2,500/hr. and μ = 2,800/hr

$W_s = \frac{1}{\mu - \lambda} = \frac{1}{2,800 - 2,500}$ = 0.0033 hr.

On an average, 2,500 customers will each wait 0.0033 hour for completion of service at a cost of ₹2 per customer per hour.

The average hourly cost of ill will = 2,500 × 0.0033 × 2 = ₹16.50

Operating cost = ₹100.00

Total (system 1) cost per hour = ₹116.50.

For system 2: Without even computing the cost of ill will on the faster system, it is seen that hourly operating costs will exceed the total cost of system 1. Hence system 1 is recommended.

(ii)

TABLE 1: Assignment of Random Numbers

No. of arrivals/ services/ day	Arriving Pattern				Servicing pattern			
	Freq.	Prob.	Cum. Prob.	RN interval	Freq.	Prob.	Cum. Prob.	RN interval
0	4	4/50	0.08	00 – 07	6	6/50	0.12	00 – 11
1	8	8/50	0.24	08 – 23	4	4/50	0.20	12 – 19

2	20	20/50	0.64	24 – 63	24	24/50	0.68	20 – 67
3	10	10/50	0.84	64 – 83	6	6/50	0.80	68 – 79
4	6	6/50	0.96	84 – 95	8	8/50	0.96	80 – 95
5	2	2/50	1.00	96 - 99	2	2/50	1.00	96 – 99

TABLE 2: Simulation Worksheet

	Arrivals		Serviced					
Day's	Random No.	Simulated arrival	Random No.	Simulated serviced	Total No. held from previous day	Total waiting for service	Number serviced	Held for next day
1	09	01	49	02	00	01	02	-
2	54	02	16	01	00	02	01	01
3	42	02	36	02	01	03	02	01
4	01	00	76	03	01	01	03	-
5	80	03	68	03	00	03	03	-
6	06	00	91	04	00	00	04	00
7	06	00	97	05	00	00	05	00
8	26	02	85	04	00	02	04	-
9	57	02	56	02	00	02	02	-
10	79	03	84	04	00	03	04	-

Average number of automobiles remaining in service for more than one day = $\frac{02}{10} = 0.2$

(iii) Productivity improvement is vital not simply for firms but also nations, which are facing international competition. At the firm level, it is one of the most important instruments to reduce costs, improve profitability, and enhance competitive strength of the firm in the market. At the national level, it means not to improve the nation's competitive position in the international market but also to check inflationary pressures in the economy. In fact, it is the backbone of supply-side Economics. At both the micro and the macro levels, increased productivity implies economy in use of productive resources.

In business, improved productivity may lead to:

1. Better consumer service through lowering of prices;
2. Increased cash flows, improved return on assets, and greater profits;
3. Increased profits that would enhance stock price substantially;
4. Increased profits that would lead to expansion of capacity and creation of new jobs;
5. Greater investment in R/D and development of new products; and
6. Better living standards. "Economists do not agree on many things, but all agree that improved living standards are dependent absolutely on increasing productivity."

2. (c) (i) A production supervisor is considering how he should assign five jobs that are to be performed to five operators. He has the following information about the wages paid to the operators for performing these jobs:

Operators ↓	Job 1	Job 2	Job 3	Job 4	Job 5
A	**10**	**3**	**3**	**2**	**8**
B	**9**	**7**	**8**	**2**	**7**
C	**7**	**5**	**6**	**2**	**4**

D	**3**	**5**	**8**	**2**	**4**
E	**9**	**10**	**9**	**6**	**10**

Assign the jobs the operators so that the aggregate cost is least. [8]

(ii)

Origin	**Profit (₹)/Unit**				**Supply**
	Destinations				
	1	**2**	**3**	**4**	
A	**40**	**25**	**22**	**33**	**100**
B	**44**	**35**	**30**	**30**	**30**
C	**38**	**38**	**28**	**30**	**70**
Demand	**40**	**20**	**60**	**30**	

Find the initial solution by Vogel's Approximation method to maximize the profit. Is the initial solution feasible? [8]

Answer:

2. (c) (i)

Row Operations

Operators ↓	Job 1	Job 2	Job 3	Job 4	Job 5
A	8	1	1	0	6
B	7	5	6	0	5
C	5	3	4	0	2
D	1	3	6	0	2
E	3	4	3	0	4

Column Operations

Operators	Job 1	Job 2	Job 3	Job 4	Job 5
A	7	0	0	0	4
B	6	4	5	0	3
C	4	2	3	0	0
D	0	2	5	0	0
E	2	3	2	0	2

Minimum No. of lines

Operators ↓	**Job 1**	**Job 2**	**Job 3**	**Job 4**	**Job 5**
A	~~7~~	~~0~~	~~0~~	~~0~~	~~4~~
B	6	4	5	0	3
C	4	2	3	0	0
D	~~0~~	~~2~~	~~5~~	~~0~~	~~0~~
E	2	3	2	0	2

As the minimum number of lines is not equal to order of matrix, let's take step to increase the number of zeros.

Operators ↓	**Job 1**	**Job 2**	**Job 3**	**Job 4**	**Job 5**
A	7	0	0	2	6
B	4	2	3	0	3
C	2	0	1	0	0
D	0	2	5	2	2
E	0	1	0	0	2

Minimum No. of lines

Operators ↓	Job 1	Job 2	Job 3	Job 4	Job 5
A	7	0	0	2	6
B	4	2	3	0	3
C	2	0	1	0	0
D	0	2	5	2	2
E	0	1	0	0	2

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

Operators ↓	Job 1	Job 2	Job 3	Job 4	Job 5
A	7	[0]	0	2	6
B	4	2	3	[0]	3
C	2	0	1	0	0
D	[0]	2	5	2	2
E	0	1	[0]	0	2

Optimal Assignment

Operators ↓	Job	Cost
A	2	3
B	4	2
C	5	4
D	1	3
E	3	9
Total		21

(ii)

Origin	Profit (₹)/Unit					Supply
	Destinations					
	1	**2**	**3**	**4**	**Dummy**	
A	40	25	22	33	0	100
B	44	35	30	30	0	30
C	38	38	28	30	0	70
Demand	40	20	60	30	50	200

Opportunity Loss Matrix

Origin	Opportunity Loss (₹)/Unit					Supply	D_1	D_2	D_3	D_4	D_5
	Destinations										
	1	2	3	4	Dummy						
A	4	19	22 (20)	11 (30)	44 (50)	100	7	7	7	11	22
B	0 (30)	9	14	14	44	30	9	-	-	-	
C	6 (10)	6 (20)	16 (40)	14	44	70	0	0	8	2	28
Demand	40	20	60	80	50	200					
D_1	4	3	2	3	0						
D_2	2	13	6	3	0						
D_3	2	-	6	3	0						
D_4	-	-	6	3	0						
D_5	-	-	6	-	0						

Initial Solution

From	A	A	A	B	C	C	C
To	D_3	D_4	Dummy	D_1	D_1	D_2	D_3
Units	20	30	Dummy	30	10	20	40
Feasibility test	m + n – 1= 7		No. of allocations = 7			The solution is feasible	

2. (d) (i) Draw network. Determine the critical path and duration of the project. Make float analysis. (Duration in weeks)

Activity	1- 2	1- 3	2- 4	3- 4	3- 5	4- 9	5- 6	5- 7	6 -8	7- 8	8 – 9	8 – 10	9 –10
Duration	4	1	1	1	6	5	4	8	1	2	1	8	7

[8]

(ii) Transport Ltd. provides tourist vehicles of 3 types – 20-seater vans, 8-seater big cars and 5 – seater small cars. These seating capacities are excluding the drivers. The company has 4 vehicles of the 20 –seater van type, 10 vehicles of the 8 – seater big car types and 20 vehicles of the 5 –seater small car types. These vehicles have to be used to transport employees of their client company from their residences to their offices and back. All the residences are in the same housing colony. The offices are at two different places one is the Head Office and the other is the Branch. Each vehicle plies only one round trip per day, if residence to office in the morning and office to residence in the evening. Each day, 180 officials need to be transported in Route I (from residence to Head office and back) and 40 officials need to be transported in Route II (from residence to Branch office and back). The cost per round trip for each type of vehicle along each route is given below.

You are required to formulate the information's as a liner programming problem, with the objective of minimizing the total cost of hiring vehicles for the client company, subject to the constraints mentioned above.
(Only formulation is required. Solution is not needed).

(₹/round trip)

	20- Seater Vans	8 – Seater big cars	5 – Seater small cars
Route – I Residence – Head Office and back	600	400	300
Route – II Residence – Branch Office and back	500	300	200

[4]

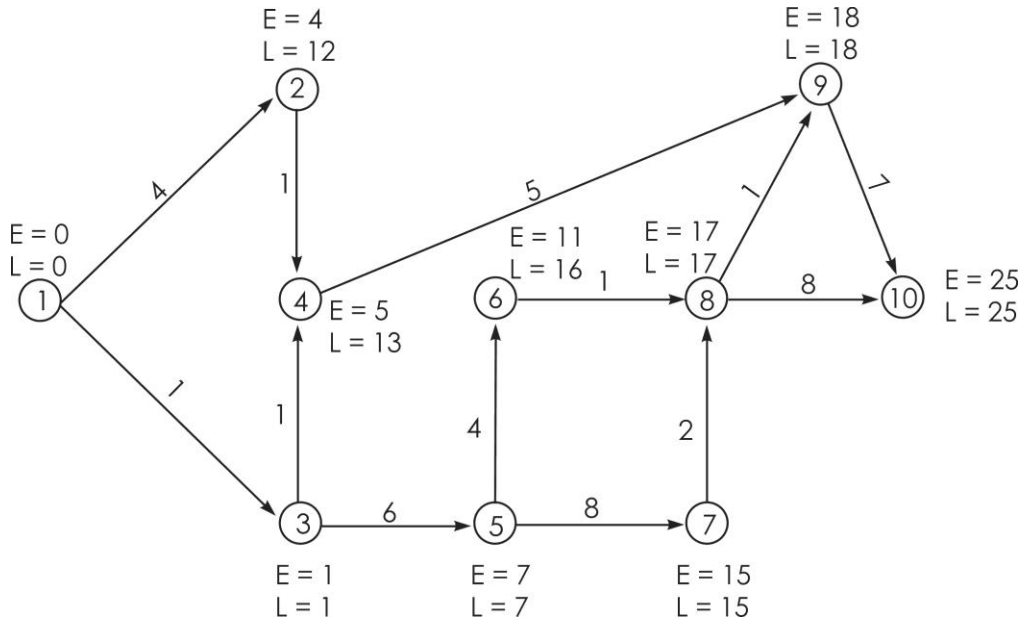
(iii) In a simulated operation, a firm's maintenance crew received requests for service and provided service during an 8 hour period as shown below:

Request arrival (clock) time	Service time (hours)
0.00	1.5
1.00	0.5
3.30	2.0
4.00	0.5
7.00	1.0

The maintenance labour cost is ₹ 140 per hour and the delay time cost is ₹ 450 per hour.
(a) Find the idle time cost for the maintenance crew.
(b) Find the delay time cost for the machinery. [2+2]

Answer:

2. (d) (i)



Paths	Duration (weeks)
1-2-4-9-10	4+1+5+7= 17
1-3-4-9-10	1 + 1+5+7 = 14
1-3-5-7-8-9-10	1+6+8+2+1+7 = 25
1-3-5-6-8-9-10	1+6+4+1+1+7=20
1-3-5-7-8-10	1+6+8+2+8=25
1-3-5-6-8-10	1+6+4+1+ 8 = 20

There are two critical paths 1-3-5-7-8-9-10 and 1-3-5-7-8-10. Duration: 25 weeks.

Activity	Duration	ES	LF	EF	LS	HES	TES	TF	FF	Ind. F	Inter. F
1-2	4	0	12	4	8	8	0	8	0	0	8
1-3	1	0	1	1	0	0	0	0	0	0	0
2- 4	1	4	13	5	12	8	8	8	0	0	8
3- 4	1	1	13	2	12	8	0	11	3	3	8
3- 5	6	1	7	7	1	0	0	0	0	0	0
4- 9	5	5	18	10	13	0	8	8	8	0	0
5- 6	4	7	16	11	12	5	0	5	0	0	5
5- 7	8	7	15	15	7	0	0	0	0	0	0
6- 8	1	11	17	12	16	0	5	5	5	0	0
7- 8	2	15	17	17	15	0	0	0	0	0	0
8- 9	1	17	18	18	17	0	0	0	0	0	0
8 -10	8	17	25	25	17	0	0	0	0	0	0
9 – 10	7	18	25	25	18	0	0	0	0	0	0

(ii) Route 1:

Let the number of 20 – seater vans = x_1, 8 – seater big cars = x_2 and 5 – seater small cars = x_3

Route 2:

Let the number of 20 – seater vans = y_1, 8 – seater big cars = y_2 and 5 –seater small cars = y_3,

Objective function: Minimize $600x_1 + 400x_2 + 300x_3 + 500y_1 + 300y_2 + 200y_3$

Subject to :

$x_1 + y_1 \leq 4$	$x_2 + y_2 \leq 10$	$x_3 + y_3 \leq 20$
$20x_1 + 8x_2 + 5x_3 \geq 180$	$20y_1 + 8y_2 + 5y_3 \geq 40$	$x_1, x_2, x_3, y_1, y_2, y_3 \geq 0$

(iii)

Request arrival time (clock time)	Repair time for one crew		Repair time begins-ends (Clock time)		Machine down time		
	Hours	mines.			Waiting time	Repair time	Total time
00.00	1.50	90	00.00	01.30	Nil	1.5	1.5
01.00	0.50	30	01.30	02.00	0.5	0.5	1.0
03.30	2.00	120	03.30	05.30	Nil	2.0	2.0
04.00	0.50	30	05.30	06.00	1.5	0.5	2.0
07.00	1.00	60	07.00	08.00	Nil	1.0	1.0
Total	5.50 hrs.				2.0	5.5	7.5

Idle time for the maintenance crew = 8 – 5.5 = 2.5 hrs.

Idle time cost for maintenance crew = 2.5 × 140 = ₹ 350

Delay time or waiting time = 2.0 hours

Delay time cost for the machinery = 2.0 × 450 = ₹ 900

Information System

Answer any two questions.

3.(a) (i) Write a note on Entropy. [2]

(ii) Describe Information System Organization. [6]

(iii) Describe the different System Costs. [3]

(iv) State the Different Roles Involved in System Development Life Cycle. [5]

Answer:

3. (a) (i) 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	Manifestation of Entropy	Negative Entropy
Automobile	Engine won't start, tyres too thin.	Tune up engine, Replace tyres.
Computer Program	User dissatisfaction with features and errors.	Program enhancements.

(ii) Information System Organization

Organization structure should be based on established policy and have well defined rules of responsibilities and authority at different levels. The load of data processing, resource requirement in terms of both manpower and machine must be assessed properly. Job specifications at different levels must be clearly given to avoid gaps in responsibility and performance standard also be rationally established to make the organization more scientific. The objectives of sound organization structure are to provide all possible infrastructure facilities for a good information system. To be more specific, a scientific organization structure for information system means provisions of the following:

- Proper Information Technology environment with right kind of machine, manpower & work culture.
- Right resources balancing the hardware, software and skill
- Adequate security system on data, processing and output
- Adoption of scientific and modern software development methodology etc.

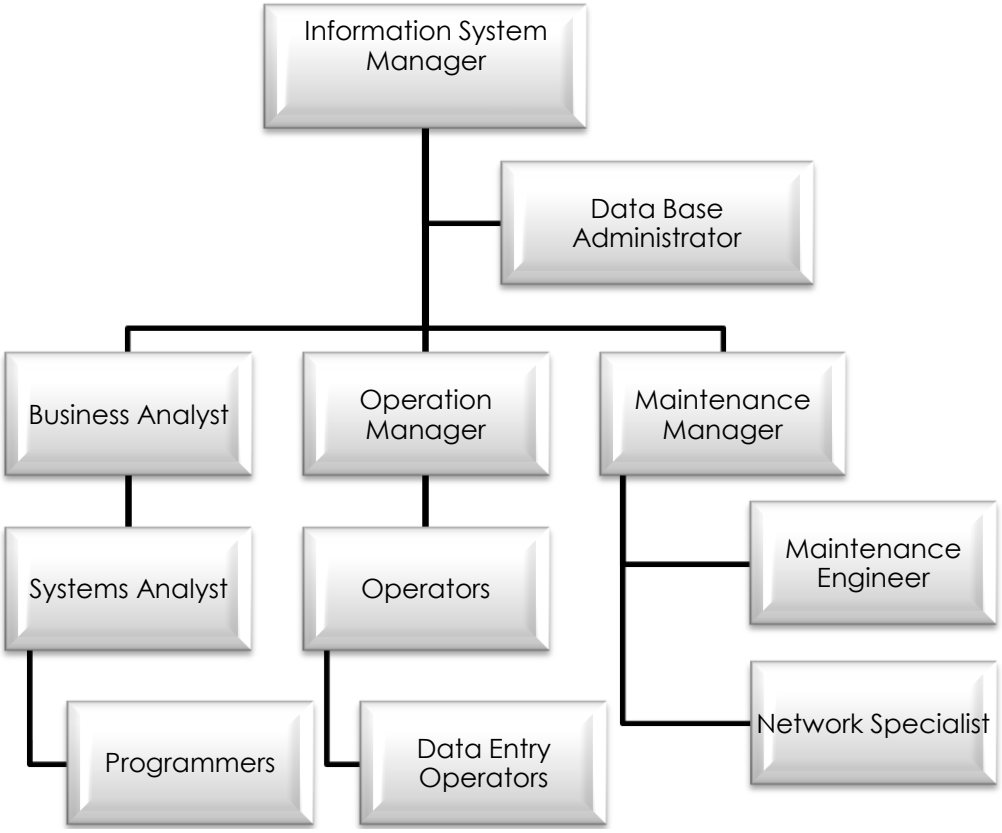
For successful implementation and operation of an information system, organizational set up has to be built to take care of certain activities on a day to day basis. Let us understand the activities involved in the information system and the responsibilities of the Information System Department.

The organizational structure of information system in an organization may vary depending on various resources available and their quality but the objectives remain almost same with main focus on effective use of information for better business control.

Activities involved in the department are:

1. System Development
2. Programming
3. Data administration
4. Security management
5. Operation management
6. Quality assurance

The different specialist groups of employees are assigned the responsibilities of the above activities in the Information System Department. The chart below will show the organization structure of a Computer based Information System department:



(iii) System costs can be sub divided into Development, Operational and Intangible costs.

(a) Development costs for a computer based information system include salaries of the system analysts and computer programmers who design and program the system, cost of converting and preparing data files ,cost of testing and documenting the system, training employees, and other costs incurred for development process.

(b) Operating costs of a computer based information system include - hardware/software rental or depreciation charges, Cost of maintaining proper physical facilities including

power, light, heat, air conditioning, or other facility charges such as equipment, building maintenance charges, overhead charges of the business firm.

(c) Intangible costs are costs that cannot be easily measured. For example, the development of a new system may disrupt the activities of an organization, Customer sales and goodwill may be lost by errors made during the installation of a new system.

Benefits: The benefits can be subdivided into –

(i) Tangible and
(ii) Intangible benefits.

(iv) Different Roles Involved in SDLC

i. Steering Committee: Some of the functions of steering committee are as below :
   - To provide overall direction
   - To be responsible for all cost and timetables.
   - To conduct a regular review of progress of the project.
   - Taking corrective actions like rescheduling, e-staffing, change in the project objectives etc.

ii. Project Manager: A project manager is responsible for delivery of project with in time and budget.

iii. Project Leader: Project leader views the project position more frequently than a project manager.

iv. System Analysts/Business analysts: System Analysts is a link between the users and the programmers who converts the user requirements in the system requirement.

v. Module Leader/ Team Leader: In developing a financial accounting application - Treasury, Accounts payable, Accounts receivable can be identified as separate modules and can be assigned to different module leaders.

vi. Programmer /Coder /Developer: Programmers converts design into programs by coding using programming language.

vii. Database Administrator (DBA): The DBA handles multiple projects and ensures the integrity and security of information stored in the database. The Inclusion of new data elements is done only with the approval of the database administrator.

viii. Quality Assurance: This team sets the standards for development, and checks compliance with these standards on a periodic basis.

ix. Tester: Tester is one who tests programs and subprograms as per the plan given by the module / project leaders and prepare test reports.

x. Domain Specialist: Domain Specialist helps the project team in developing an application which is new to project team.

3. (b) (i) 'There are other implications of using the database approach that can benefit most organizations.'- Describe them. [5]

(ii) Describe the three –schema architecture. [6]

(iii) List the information type and report contents of the three levels of management. [6]

Answer:

3. (b) (i) Implications of the Database Approach

Potential for Enforcing Standards: The database approach permits the DBA to define and enforce standards among database users in a large organization. This facilitates communication and cooperation among various departments, projects, and users within the organization. Standards can be defined for names and formats of data elements, display formats, report structures, terminology, and so on. The DBA can enforce standards in a centralized database environment more easily than in an environment where each user group has control of its own files and software.

Reduced Application Development time: A prime selling feature of the database approach is that developing a new application—such as the retrieval of certain data from the database for printing a new report—takes very little time. Designing and implementing a new database from scratch may take more time than writing a single specialized file application. However, once a database is up and running, substantially less time is generally required to create new applications using DBMS facilities. Development time using a DBMS is estimated to be one-sixth to one-fourth of that for a traditional file system.

Flexibility: It may be necessary to change the structure of a database as requirements change. For example, a new user group may emerge that needs information not currently in the database. In response, it may be necessary to add a file to the database or to extend the data elements in an existing file. Modern DBMSs allow certain types of changes to the structure of the database without affecting the stored data and the existing application programs.

Availability of Up-to-Date Information: A DBMS makes the database available to all users. As soon as one user's update is applied to the database, all other users can immediately see this update. This availability of up-to-date information is essential for many transaction-processing applications, such as reservation systems or banking databases, and it is made possible by the concurrency control and recovery subsystems of a DBMS.

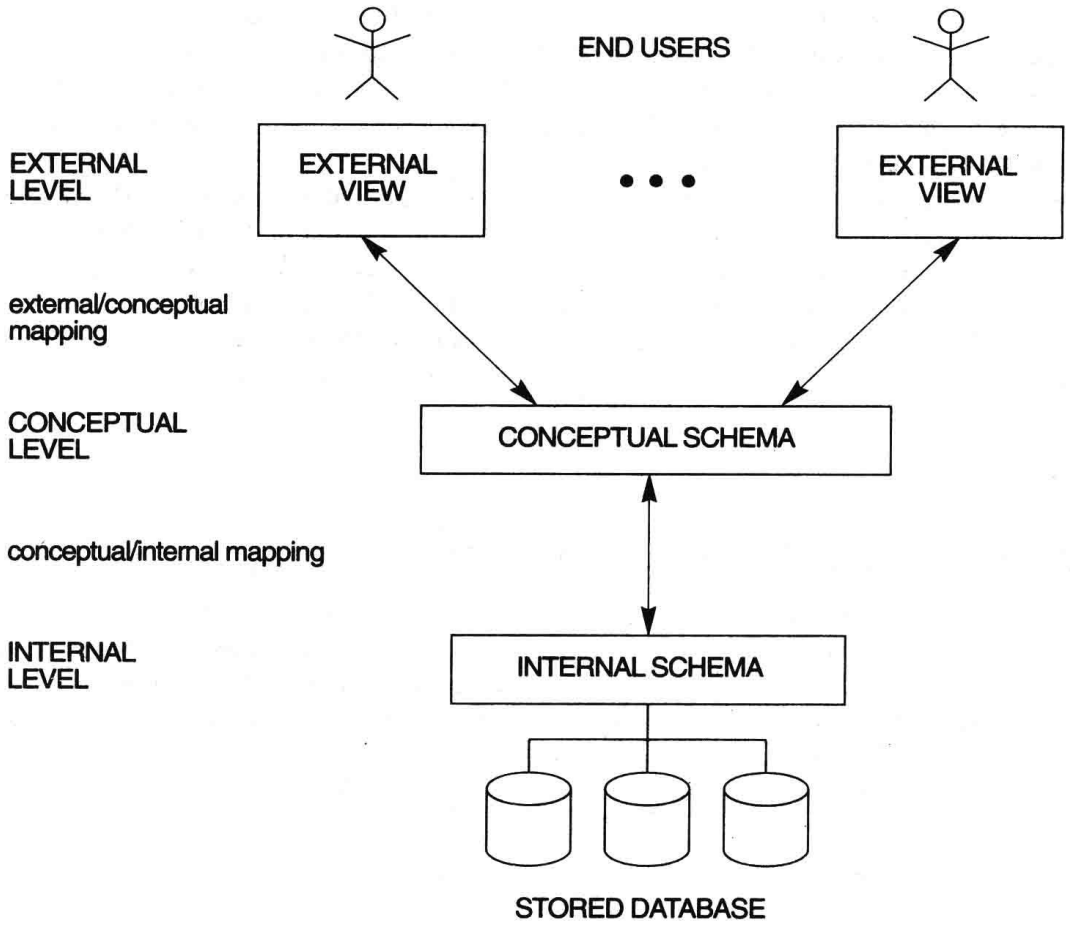
Economies of Scale: The DBMS approach permits consolidation of data and applications, thus reducing the amount of wasteful overlap between activities of data-processing personnel in different projects or departments. This enables the whole organization to invest in more powerful processors, storage devices, or communication gear, rather than having each department purchase its own (weaker) equipment: This reduces overall costs of operation and management.

(ii) The Three-Schema Architecture

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

1. The **internal level** has an **internal schema**, which describes the physical storage structure of the database. The internal schema uses a physical data model and describes the complete details of data storage and access paths for the database.
2. The **conceptual level** has a **conceptual schema**, which describes the structure of the whole database for a community of users. The conceptual schema hides the details of physical storage structures and concentrates on describing entities, data types, relationships, user operations, and constraints. A high-level data model or an implementation data model can be used at this level.
3. The **external** or **view level** includes a number of **external schemas** or **user views**. Each external schema describes the part of the database that a particular user group is

interested in and hides the rest of the database from that user group. A high-level data model or an implementation data model can be used at this level.



Illustrating the three-schema architecture.

(iii)

Level	Information type	Report contents
Top	Strategic information which are relatively unstructured and complex. Example: • Strategic decision making on production planning, new product, marketing, sales promotion etc. • Planning and Control of different activities of the organization as a whole • Financial Decision making – fund management or resource mobilization • Business policy decision	• Summary results • Comparative figures • Possible analytical presentation • Guideline for alternative options

Middle	Control information which are moderately structured and less complex . Example: • Tactical Planning • Control information for resource use and results like weekly sales of different products • Reasons of variances, if any	• Actual performance summary and variance analysis • Reports on exceptions

Level	Information type	Report contents
Operating	Supervisory information which are highly structured and simple. Example: • Control on day to day activities like production, sales, purchases, idle time etc • Scheduling the activities	• Detailed reports • Operational results • Maintenance report

3. (c) (i) Describe the different phases of ERP life cycle. [10]

(ii) State the main reasons for the Spread of E-commerce. [6]

Answer:

3. (c) (i) ERP life cycle Phases

ERP life cycles, which encompass entire 10 to 20 years of effective operating life, are often confused with ERP Implementation Life Cycle. Some of the **phases of ERP life cycle** is shown in following diagram.

1. **ERP Roll out:** The initial roll out of an ERP system itself consists of various phases commencing with Request for Proposal (RFP) and vendor selection and ending with go live and hand holding phase. Some important matter concerning this phase, as given below, will have direct bearing on subsequent phases of ERP lifecycle:
   - Degree of matching of vanilla ERP product to current business need and extent of customization done, particularly source code customization.
   - Commitment of the vendor for future development and their financial health
   - Support issues including License fees and escalation thereof.

2. **Optimization:** After the system is live and rolled out, there will be a period of turmoil. Due to lack of understanding, a lot of confusion will prevail amongst users. There will be teething problems and some software bugs will invariably appear. With retraining, some tweaking of the system and assistance from a responsive help desk, this phase should be over within six months to one year and the system should start stabilizing.

3. **Maintenance:** This is the longest period of life cycle, when the organization starts realizing value of their investment. Users will get familiar and start owning the system. Some changes will be continuing such as new reports, different workflows, some localization on taxes etc. Maintenance will be covered by service level agreement, entailing payment of license fee to the vendor. For a complicated system, there may be a third party vendor, helping maintenance at site. The license fee, due to provision of escalation, gets escalated at regular intervals and after some years, adversely affects Total Cost of Ownership (TCO).

4. **Extending Values:** This phase overlap with the phase of maintenance. New or changed business processes necessitate minor or moderate changes in the system. There may be extensive changes under scenario such as (i) implementing a new accounting system e.g. International Finance Reporting standard (IFRS) (ii) A new regulatory requirement like Goods and Service Tax Act (GTA) (iii) Mergers and acquisitions/restructuring (iv) Extending the system with add on products such as Customer Relationship Management and Business Intelligence (BI). Sometime the cost changes may be prohibitive, particularly for systems where a lot of customization has been done during implementation phase.
   Parallel to business changes, technological changes also occur. New release and versions appear for underlying technological platforms like Operating System and Data Base. ERP vendors release patches and versions of their products at regular intervals which needed to be incorporated in the existing system. This usually involves minor or moderate efforts. But, problem arises where many software objects were customized during implementation. Retrofitting these objects for making them compatible with later versions, may turn out to be a major migration exercise involving exorbitant cost and effort.
5. **Decaying Performance:** For an enterprise, business need and technological requirement continue to evolve. Cost, Complexity and difficulty to modify and update the existing system mount. Fixing existing system is no more viable and provides diminishing return. Alternatives are investigated and decision of reimplementation is taken.
6. **Reimplementation:** Similar to Roll Out phase as mentioned above. However, the organizations are better organized now. Initial process will be carried out more professionally. It is likely that they will adopt more of a vanilla version with minimum need of customization, so that the next cycle gives a better Return on Investment (ROI).

(ii) Main Reasons for the Spread of E-commerce:

- Digital convergence, i.e., it means that due to digital revolution almost all digital devices can communicate with one another.
- Today's E-commerce is available to anyone, anywhere in the world, anytime 24/7 (24 hours a day, 7 days a week).
- It helps in bringing about positive changes in an organization.
- People are now having a widespread access to IT and Personal Computers (PCs).
- E-commerce helps in reducing operating costs and increasing profit margins due to global operations.
- Demand for customized products and services are increasing.