INTERMEDIATE EXAMINATION

GROUP II

(SYLLABUS 2012)

SUGGESTED ANSWERS TO QUESTIONS
DECEMBER 2013

Paper-9 : OPERATION MANAGEMENT AND INFORMATION SYSTEM

Time Allowed : 3 Hours   Full Marks : 100

The figures in the margin on the right side indicate full marks.

Operation Management
Answer Question No. 1 which is compulsory and any 4 questions from the rest.

1. (a) What are the two measures of Forecast Error?   1x12=12
    (b) _____ is typically found wherever a particular bottleneck machine exists in the process of manufacturing.
        (i)   Load control
        (ii) Block control
        (iii) Flow control
        (iv) Order control
    (c) A department of a company has to process a large number of components/month. The process equipment time required is 30 minutes/component and the manual skilled manpower required is 10 minutes/component. The following additional data is available:

	Availability/month	Efficiency of utilization
Equipment hour	400	80%
Skilled manpower-hours	250	65%

   What is the maximum possible production under the current conditions?
    (d) In a firm, there are four workstations: A, B, C, & D working in series and their individual capacities in units per day are 400, 380, 350 and 410 respectively. The raw materials are fed to Machine A and the system output is obtained from Machine D. If the actual output is 320 units per day, what is the system efficiency?
    (e) An analyst wants to obtain a cycle time estimate that is within ± 5% of the true value. A preliminary run of 10 cycles took 50 minutes to complete and had a calculated standard deviation of 0.4 minutes. What is the coefficient of variation to be used for computing the sample size for the forthcoming time study?
    (f) A firm uses ₹ 20,00,000 in capital and 20,000 labour hours per year to produce ₹ 2,00,00,000 in product. What is the partial productivity of labour?
    (g) Solve the game by dominance property:

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        9               2
        8               6
        6               4
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    (h) Calculate EBQ from the details: Monthly demand -2000 units, Setting up costs per batch – ₹ 100, cost of manufacture per unit – ₹ 30, rate of interest -10% p.a.
    (i) Shin's Car Wash & Dry is an automatic, five-minute operation with a single bay. On a typical Saturday morning, cars arrive at a mean rate of ten per hour, with arrivals tending

to follow a Poisson distribution. **Find the average number of cars in line.**

(j) The term 'Poka Yoke' is related to _____ .
   (i) Material Requirement Planning
   (ii) Scheduling
   (iii) PDCA cycle
   (iv) Fool-proofing
(k) How are spare parts classified for stocking policy analysis?
(l) Give the formula for 'Throughput Time'.

Answer:

1. (a) Mean Absolute Deviation (MAD) and Bias

(b) (i) Load control

(c) Actual Equipment Hrs. used = 400 x 80/100 = 320 Hrs.
Possible output = 320 x (60/30) = 640 Components
Skilled manpower Hrs. used = 250 x 65/100 = 162.5 Hrs.
Possible output =162.5 x (60/10) = 975 Components.
The bottle-neck capacity = 640 Components. Hence Maximum possible production under the given conditions = 640 Components.

(d) The bottle neck centre i.e. the work centre having the minimum capacity is C.
System capacity i.e. the capacity of the bottle neck centre is 350 units.
System efficiency = Actual output/ System capacity = (320/350) x 100 = 91.43%

(e) Standard deviation of sample(s) = 0.4 min/cycle.

Mean of sample = x = $\dfrac{50\,min}{10\,cycle}$ = 5 min/cycle

$V = \dfrac{s}{x} = \dfrac{0.4}{5} = 0.08$

(f) Partial productivity of labour = Total Outputs/Labour Hours
= ₹ 2,00,00,000/20,000 = ₹ 1,000

(g) Here it is assumed that Player A is playing vertically while Player B is playing horizontally. B_1 is dominated by B_2. So, we exclude the first column from our pay-off matrix.

		B_2	
	A_1	2	
Player A	A_2	6	
	A_3	4	B_2

We see that player A will adopt A_2. Thus we get A_2[6]. So, saddle point = (A_2, B_2) and value of the game = 6.

(h) Economic Batch Quantity $= \sqrt{\dfrac{2 \times Annual\ demand \times set\text{-}up\ cost}{Unit\ cost \times Inventory\ carrying\ cost\ per\ unit\ per\ year}}$

$= \sqrt{\dfrac{2 \times 2,000 \times 12 \times 100}{30 \times 0.10}} = \sqrt{16,00,000} = 1,264.91$

(i) λ = 10 cars per hour
μ = 1 per 5 minutes, or 12 per hour

$Lq = \dfrac{\lambda^2}{2\mu(\mu - \lambda)} = \dfrac{10^2}{2(12)(12-10)} = \dfrac{100}{48} = 2.08\,cars$

(j) (iv) Fool-proofing

(k) Regular spares, Insurance spares, Capital spares and Rotable spares

(l) Throughput time = Work-in-progress / Throughput rate

2. (a) What is ASRS? 2
(b) For a network shown in figure, normal time, crash time, and normal costs are given in the table; construct the network by crashing it to optimum value and calculate the critical path, project duration, activities with least cost slope and optimum project cost. Indirect cost is given as ₹ 95 per day. 10
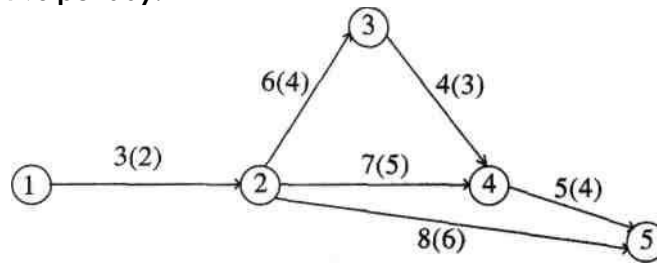

Table : Activity Relationship

Activity	Normal		Crash	
	Time (days)	Cost (₹)	Time (days)	Cost (₹)
1-2	3	300	2	400
2-3	6	480	4	520
2-4	7	2100	5	2500
2-5	8	400	6	600
3-4	4	320	3	360
4-5	5	500	4	520

Answer:

2. (a) Automated Storage and Retrieval Systems i.e., ASRS: Computer controlled warehouses use ASRS; which provide for the automatic placement and withdrawal of parts and products into and from designated storage places in the warehouse. Such systems are commonly used in distribution facilities of retailers.

(b)
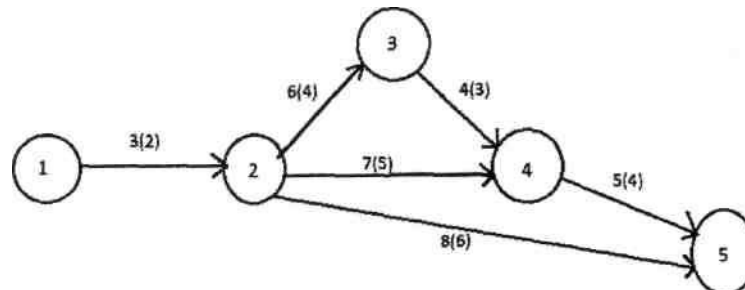
From the network diagram, critical path is 1-2-3-4-5 and the project duration is 18 days.

Cost Slopes Table

Activity	Normal	Crash		Crash	Normal	Cost

	Time (days)	Cost (₹)	Time (days)	Cost (₹)	Cost-Normal Cost (a)	Time-Crash Time (b)	Slope (a)/(b)
1-2	3	300	2	400	100	1	100
2-3	6	480	4	520	40	2	20
2-4	7	2100	5	2500	400	2	200
2-5	8	400	6	600	200	2	100
3-4	4	320	3	360	40	1	40
4-5	5	500	4	520	20	1	20

Table showing the different paths in the network with its durations

Path	Sequence	Target Time	Time Crashed at Various Stages		
			2-3	3-4	4-5
PI	1-2-3-4-5	18	16	14	15
P2	1-2-4-5	15	15	15	14
P3	1-2-5	11	11	11	11

Critical Path activities, 2-3 and 4-5, have least cost slopes. Therefore, crashing the activities 2-3 and 4-5 by 2 days and 1 day respectively, Project Duration =18-3 = 15 days.

Cost of project = Normal cost + extra crashing cost + indirect cost
= (300 +480 +2100 +400 +320 +500)+ (2 x 20 + 1 x 20) + 15 x 95 = ₹ 5,585

In second stage, crashing the least cost slope activity 3-4 on critical path by 1 day, Project duration = 14 days.

Cost of Project = Normal cost + extra crashing cost + indirect cost
= 4100 + (20 x 2 + 1 x 20 + 1 x 40) + 14 x 95 = ₹ 5,530

The total project cost with normal activities (without crashing) = Normal cost + indirect cost for 18 days = 4100 + (18x95) = ₹ 5,810

Therefore, the optimum cost of the project is ₹ 5,530.

3. **(a) What are the limitations of Preventive Maintenance?** **2**

(b) A solicitor's firm employs typists on hourly piece-rate basis for daily work. There are four typists and their charges and speed are different. It has been agreed that only one job will be given to one typist and the typist is paid for a full hour even when he works for a fraction of an hour. Find the least cost allocation for the following data:

Typist	Rate/hour	Number of pages typed/hour	Job	No. of pages
A	4	8	P	102
B	3	10	Q	135
C	5	11	R	110
D	3	9	S	85

10

Answer:

3. **(a)** The limitations of Preventive Maintenance are:
   (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.

   (b)

Total Cost Matrix

Typist	Job			
	P	Q	R	S

A	102/8=12.75 i.e. 13x4=52	135/8=16.88 i.e. 17x4=68	110/8=13.75 i.e. 14x4=56	85/8=10.63 i.e. 11x4=44
B	102/10=10.2 i.e. 11x3=33	135/10=13.5 i.e. 14x3=42	110/10=11 i.e. 11x3=33	85/10=8.5 i.e. 9x3=27
C	102/11=9.27 i.e. 10x5=50	135/11=12.27 i.e. 13x5=65	110/11=10 i.e. 10x5= 50	85/11=7.72 i.e. 8x5=40
D	102/9=11.33 i.e. 12x3=36	135/9=15 i.e. 15x3=45	110/9=12.22 i.e. 13x3=39	85/9=9.44 i.e. 10x3=30

Subtracting the minimum element of each row from all its elements, we obtain:

Reduced Cost Table: 1

Typist	Job			
	P	Q	R	S
A	8	24	12	0
B	6	15	6	0
C	10	25	10	0
D	6	15	9	0

Subtracting the minimum element of each column from all the elements, we obtain:

Reduced Cost Table: 2

Typist	Job			
	P	Q	R	S
A	2	9	6	0
B	0	0	0	0
C	4	10	4	0
D	0	0	3	0

Here, the minimum number of lines to cover all zeros is equal to 3, which is smaller than order 4, of the given matrix. The revised table is prepared by considering the least uncovered value, 2, and adjusting it with uncovered cell values and those lying at the intersection of lines.

Typist	Job			
	P	Q	R	S
A	0	7	4	X
B	X	X	0	2
C	2	8	2	0
D	X	0	3	2

The minimum number of lines to cover all zeros equal 4, which matches with the order of the matrix. Assignment can be made as follows:

Typist	Job	Cost
A	P	52
B	R	33
C	S	40
D	Q	45
Total		**170**

4. **(a) What is 'Vertical integration'? State its pros and cons, conducted in order to ascertain the product acceptability.** 1+4
   (b) What are the merits of Delphi method of forecasting technique? 5
   (c) If a firm sells 5000 units, its loss is ₹ 10,000. But if it sells 9000 units, its profit is ₹10,000. Calculate its (i) Fixed Cost; (ii) BEP. 2

Answer:

4. **(a)** Vertical integration is the amount of the production and distribution chain, from suppliers of components to the delivery of products/services to customers, which is brought under the ownership of a firm. Pros of vertical integration are:
   (i) Can sometimes increase market share and allow the firm enter foreign markets more easily.
   (ii) Can achieve savings in production cost and produce higher quality goods.
   (iii) Can achieve more timely delivery.
   (iv) Better utilisation of all types of resources.

   Cons of vertical integration are:
   (i) Not attractive for low volumes.
   (ii) High capital investment and operating costs.
   (iii) Less ability to react more quickly to changes in customer demands, competitive actions and new techniques.

   (b) Delphi is preferred for the following reasons:
   • It involves knowledgeable persons on the subject.
   • Members in Delphi exercise come from different backgrounds and therefore the method is able to consider and pool up various aspects of the issue.
   • Since the members do not meet each other, their views are not influenced by the views of other.
   • No conflict of personality is seen in the process.
   • No dominance by any influential expert on the other experts.
   • It gives quick results as compared to quantitative techniques and helps in timely decisions.

   (c) (i) Change in quantity of output = 9000 - 5000 = 4000 units
   Change in profit = ₹ 10,000 - (- ₹10,000) = ₹ 20,000
   Unit contribution = Change in profit / Change in output
   = ₹ 20,000/4,000 = ₹ 5
   So, when output is 9000 units,
   Total Contribution i.e., F+P = ₹ (5x9000) = ₹ 45,000
   but given Profit, P = ₹ 10,000
   Therefore, F = TC - P = ₹ 45,000 – ₹ 10,000 = ₹ 35,000
   (ii) Break - even point (units) = Fixed Cost / Unit Contribution = ₹ 35,000 / ₹ 5 = 7,000 units

5. **(a) A company plans to fill four positions and it decides to conduct aptitude tests and interviews for the same. While the aptitude tests are conducted by people from the clerical positions, the job interviews are held by the personnel from the management cadre. The job interviews immediately follow the aptitude test. The time required (in minutes) by each of the positions is given here,**

Position	P1	P2	P3	P4
Aptitude Test	100	110	140	120
Job Interview	70	90	80	110

   If it is desired to minimise the waiting time of the management personnel, in what order the

position filling be handled? **5**

(b) **Arzuu Ltd.'s records of breakdowns of its machines for a 300 day work year as shown below:**

No. of breakdown	Frequency in days
0	40
1	150
2	70
3	30
4	10
	300

The firm estimates that each breakdown costs ₹ 600 and is considering adopting a preventive maintenance program which would cost ₹ 200 per day and limit the number of breakdown to an average of one per day.

What is the expected annual savings from preventive maintenance program? **5**

(c) **Kindly mention the Principles of Total Quality.** **2**

Answer:

5. (a) From the given information, the optimal sequence can be determined using the algorithm. This would be P4, P2, P3 and P1. Calculation of total elapsed Time T

Position	Aptitude Test		Job Interview	
	Start	Finish	Start	Finish
P4	0	120	120	230
P2	120	230	230	320
P3	230	370	370	450
P1	370	470	470	540

The total elapsed time T is equal to 640 minutes as calculated above, while the idle time for the management personnel would he: 120 + 100 + 50 + 20 = 290 minutes.

(b)

No. of breakdowns (x)	Frequency of breakdowns in days i.e., f(x)	Probability distribution of breakdowns P(x)	Expected value of breakdowns (x) × P(x)
0	40	40/300 = 0.133	Nil
1	150	150/300 = 0.500	0.500
2	70	70/300 = 0.233	0.466
3	30	30/300 = 0.100	0.300
4	10	10/300 = 0.033	0.132
Total	300	1.000	1.400

Total no. of breakdowns per day = 1.40
Cost of breakdown per day = 1.40 × ₹ 600 = ₹ 840
Cost of preventive maintenance programme per day = ₹ 200 + ₹ 600 = ₹ 800
Expected annual savings from the preventive maintenance programme = ₹ (840-800) × 300days = ₹ 40 × 300 = ₹12,000

(c) Principles of Total Quality are as follows:
- Focus on the customer (Both internal & external)
- Participation and Team work
- Employee involvement and empowerment
- Continuous improvement and learning.

6. (a) What are the advantages of KAIZEN Technique?   **4**
     (b) State the three models of Productivity Measurement.   **3**
     (c) Identify the relationship between R & D Inputs and Output.   **5**

Answer:

6. (a) The advantages of KAIZEN are as follows :
     (i) The first and foremost benefit of KAIZEN is that it brings about attitudinal changes among employees towards improvements of their routine work. Hence it increases the productivity and a new work culture is created in the organisation.
     (ii) Once the culture is transformed, the way gets cleared for introducing other productivity improvement systems like JIT, kanban etc. obviously leading to productivity improvement.
     (iii) KAIZEN system reduces resistance to change.
     (iv) Ownership of work improves in KAIZEN environment. It is the inner voice of the employees that drives them to make the improvements, rather than the orders given down through the hierarchy.

(b) The models of Productivity Measurement can be classified into three on the basis of the type and coverage of the output and input variables, (a) Ratio method (b) Production Function method (c) P-O-P method.

(c) Some important variables determining R & D efforts and its success have been identified as follows:
     (i) The size of the operation has been found to be positively related to the success of R & D.
     (ii) The presence of technological opportunities in the industry leads to better R & D efforts.
     (iii) The philosophy and genuine efforts of the management are necessary for successful R & D efforts.
     (iv) The contribution of individual researchers to R & D has been found to be quite substantial.
     (v) R & D efforts are likely to be more effective where growth prospects are good and profits are likely to be high.
     (vi) Diversification is positively related to the R & D efforts, as there is scope of their utilization.
     (vii) A number of studies have suggested a strong relationship between R & D and the marketing opportunities for a new product. Market opportunities have been found to contribute three times more than technical opportunities as sources for innovations.

Information Systems

Answer Question No. 7, which is compulsory and any 4 questions from the rest.

7. (a) What is a Deterministic type of System?
     (b) From the following two relations of X and Y, find XUY.

Relation X

Batch No.	Course
1	BA
2	CMA
2	BCOM
4	CA

Relation Y

Batch No.	Course
1	BA
2	CMA
2	BCOM
4	CA
5	SAT
6	MA

(c) What are the various types of financial models?

(d) What are the important components of General Ledger?   2x4 = 8

Answer:

7. (a) A deterministic system operates in a predictable manner wherein the interaction among the parts is known with certainty. An example is a correct computer program, which performs exactly according to a set of instructions.

(b)

XUY

Batch No.	Course
1	BA
2	CMA
2	BCOM
4	CA
5	SAT
6	MA

(c) The following are the various types of financial models:
- Mathematical models
  - ➢ Highly abstract
  - ➢ Emphasis on structural relationships
- Empirical models
  - ➢ More value-specific assumptions
  - ➢ Specific quantitative outcomes sought
- Spreadsheet models
  - ➢ Codified empirical models

(d) The important components of General Ledger are:
1. General Ledger master data set up.
2. General Ledger integration set up with logistics modules.
3. Period and year closing.

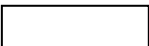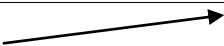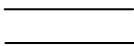**8. (a)** State the main reasons for the Spread of E-commerce.   4

(b) What is an Executive Information System?   2

(c) Match the following with respect to a Data flow Diagram.   2

Column 1		Column 2	
(i)	[rectangle]	(A)	Transformation Process
(ii)	[arrow]	(B)	Data Stores
(iii)	[oval]	(C)	Data Sources and Destination
(iv)	[open rectangle]	(D)	Data Flow

Answer:

8. **(a)** The main reasons for the Spread of E-commerce are:
   (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).
   (iii) It helps in bringing about positive changes in an organization.
   (iv) People are now having a widespread access to it and personal Computers (PCs).
   (v) E-commerce helps in reducing operating costs and increasing profit margins due to global operations.
   (vi) Demand for customized products and services is increasing.

   (b) 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'.

   (c) (i) - C,
   (ii) - D,
   (iii) - A,
   (iv) - B.

9. **Discuss the areas which would help in analyzing/investing the Present System.** 8
   OR
   Illustrate the Three Schema Architecture.

Answer:

9. The following areas would help in analyzing/investing the Present System:
   (a) Review historical aspects: A review of annual reports and organization chart can identify the hierarchy of management levels. The historical facts should identify the major turning points that have influenced its growth; the system analyst should also investigate what system changes have occurred in the past.
   (b) Analyze inputs: Source documents are used to capture the originating data. The system analyst should study in depth various sources from where the data are initially captured to understand the existing system. The system analyst must understand the nature of each form, the distribution of the form.
   (c) Review data files maintained: The analyst should investigate the data files maintained by each department and should know where they are located, who uses them. System and procedural manual should also be checked.
   (d) Review methods, procedures and data communications : System analyst must review the types of data communication equipments including data interface, data links, modems, dial-up and leased lines and multiplexers to understand how the data communication network is used in the present system. A procedure's review is an intensive survey of the methods by which each job is accomplished, the equipment utilized and the actual location of the operations.
   (e) Analyze outputs: The outputs or reports should be scrutinized carefully by the system analysts in order to determine whether they meet the organization's needs.
   (f) Review internal controls: A review of the present system of internal controls may indicate weaknesses that should be removed in the new system. Locating the control points helps the analyst to visualize the essential parts and framework of a system.
   (g) Undertake overall analysis of present system: Based upon the aforesaid investigation of the present information system, the final phase of the detailed investigation includes the analysis of the present work volume, the current personnel requirements,

the present benefits and costs and each of these must be investigated completely.

OR

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.
2. The conceptual level has a conceptual schema, which describes the structure of the whole database for a community of users.
3. The external or view level includes a number of external schemas or user views.
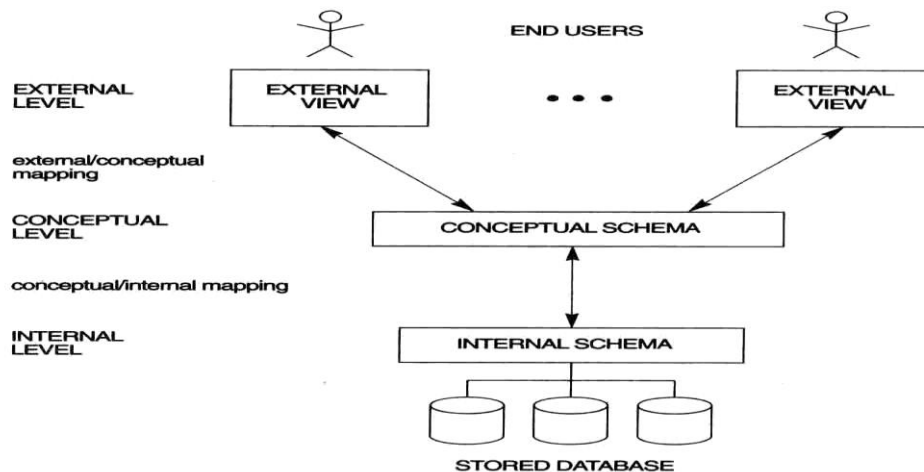
Illustrating the three-schema architecture.

10. **(a) Define Electronic Financial Transaction (EFT).** 2
   OR
   Define Domains.
   (b) Briefly explain the fact finding techniques used by the system analyst to find the needs of an organisation. 4
   (c) What are the components of Business Information System? 2

Answer:

10. (a) Electronic Financial Transaction (EFT) refers to a process by which money is transferred from one person's bank account to another person's account electronically rather than using a cheque or transferring cash. Of course, these electronic transfers are also available to governments and businesses.

OR

In a relational database domain is the datatype describing the types of values (which may appear in each column of the database). For example: a domain, say domain "D" in a relational database which is a set of atomic values, here, by atomic value, we mean that each value in the domain is not divisible as far as that relational model concerned.

(b) The following are the fact finding techniques used by the system analyst for determining the needs/ requirements of an organization:
   (i) **Documents:** Analysts collect the hierarchy of users and manager responsibilities, job descriptions for the people who work with the current system, procedure manuals, program codes for the applications associated with the current system

to understand the existing system.

(ii) **Questionnaires:** Users and managers are asked to complete questionnaire about the problems with the existing system and requirement of the new system. Using questionnaires, a large amount of data can be collected fastly.

(iii) **Interviews:** Users and managers may also be interviewed to extract information in depth.

(iv) **Observation:** Observation plays a key role in requirement analysis. Only by observing how users react to prototypes of a new system, the system can be successfully developed.

(c) Business Information System comprises of:
(i) Transaction Processing System
(ii) Management Information System
(iii) Expert System
(iv) Decision Support System
(v) Executive Information System

11. **"End users are the people whose jobs require access to the database for querying, updating and generating reports; the database primarily exists for their use." Explain the different categories of end use₹** **8**

Answer:

11. The following are the different categories of database end users:

1. Casual end users occasionally access the database, but they may need different information each time, they use a sophisticated database query language to specify their requests and are typically middle- or high-level managers or other occasional browsers.

2. Naive or parametric end users make up a sizable portion of database end users; their main job function revolves around constantly querying and updating the database, using standard types of queries and updates—called canned transactions—that have been carefully programmed and tested. The tasks that such users perform are varied:
   • Bank tellers check account balances and post withdrawals and deposits.
   • Reservation clerks for airlines, hotels, and car rental companies check availability for a given request and make reservations.
   • Clerks at receiving stations for courier mail enter package identifications via bar codes and descriptive information through buttons to update a central database of received and in-transit packages.

3. Sophisticated end users include engineers, scientists, business analysts, and others who thoroughly familiarize themselves with the facilities of the DBMs so as to implement their applications to meet their complex requirements.

4. Stand-alone users maintain personal databases by using ready-made program packages that provide easy-to-use menu- or graphics-based interfaces; an example is the user of a tax package that stores a variety of personal financial data for tax purposes.

   A typical DBMS provides multiple facilities to access a database. Naive end users need to learn very little about the facilities provided by the DBMS; they have to understand only the types of standard transactions designed and implemented for their use. Casual users learn only a few facilities that they may use repeatedly. Sophisticated users try to learn most of the DBMs facilities in order to achieve their complex requirements. Standalone users typically become very proficient in using a specific software package.

12. (a) List out the different objectives of MIS.   **4**
    (b) What is configuration in ERP? List the General Mode of Configuration.   **4**

Answer:

12. (a) Objectives of MIS are as follows:
- To provide the managers at all levels with timely and accurate information for control of business activities.
- To highlight the critical factors in the operation of the business for appropriate decision making.
- To develop a systematic and regular process of communication within the organization on performance in different functional areas.
- To use the tools and techniques available under the system for programmed decision making.
- To provide best services to customers.
- To gain competitive advantage.
- To provide information support for business planning for future.

(b) Configuration of an ERP system deals with handling of numerous usage controls, which can be switched off or switched on, so as to balance its functionalities to extant needs. General Mode of Configuration:
1. A function can be turned on or turned off or made optional.
2. XOR i.e., to chooses only one flow that fulfills the specified condition.
3. OR where a configuration supports optional activities or flow requiring all, none or some of the activities.
4. AND - indicate mandatory parallel flows.