

INTERMEDIATE EXAMINATION GROUP II (SYLLABUS 2012)

SUGGESTED ANSWERS TO QUESTIONS JUNE 2015

Paper-9: OPERATION MANAGEMENT AND INFORMATION SYSTEMS

Time Allowed : 3 Hours

Full Marks : 100

This paper contains three 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 indicated.

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

1. Answer all questions. 2x10=20
- (a) In what way does the objective of 'value engineering' differ from that of 'Value analysis'? 2
- (b) Calculate the number of components that can be produced in a month when available equipment hours are 480 per month, efficiency of utilization is 85%, and it takes 36 minutes of processing time in the equipment for each component. 2
- (c) The time study of a machinery operation recorded average cycle time of 9.0 minutes. The analyst rated the observed worker as 90%. The firm uses a 0.15 allowance fraction. Compute the standard time. 2
- (d) What are the different approaches to overcome hurdles in the management of productivity improvements? 2
- (e) What is 'Bill of Materials'? 2
- (f) Fill in the blanks:
In applications of queuing theory in maintenance, the machine breakdowns are the _____ in the queue and they may have their own _____ distribution. 2
- (g) According to Working/output, differentiate between 'Deterministic System' and 'Probabilistic System'. 2
- (h) In a Database management System, what are the names of different categories of 'end users'? 2
- (i) Re-draw the Table accurately: 2
- | | |
|------------------------|--------------------------|
| Levels of Management | Activities of Management |
| Top Management | Day-to-day activities |
| Middle Management | Strategic Planning |
| Operational Management | Resource Management |
- (j) What is primary purpose of introducing ERP and BPR in an organization? 2

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1. (a) Value engineering aims at cost reduction at equivalent performance. It can reduce costs to the extent of 15% to 70% without reducing quality. While value engineering focuses on preproduction design improvement, value analysis, a related technique, seeks improvements during the production process.
- (b) Actual Equipment Hrs. that can be used = $480 \times 85 \div 100 = 408$ Hrs.
Possible output = $408 \times (60 \div 36) = 680$ Components.
- (c) Standard Time = $(9.0 \times 0.9) \div (1 - 0.15) = 9.53$ minutes.
- (d) Different approaches to overcome hurdles in the management of productivity improvements are:
- (i) Management by internal motivation (i.e., KAIZEN).
 - (ii) Management by incentives.
 - (iii) Management by fear.
- (e) Bill of materials is nothing but a document which shows for a given product or sub-unit, the list of materials required, unit consumption, and location code (for storage). The condition of supply such as "bought-out" or "made in-house" will also be indicated.
- (f) In applications of queuing theory in maintenance, the machine breakdowns are the "arrivals" in the queue and they may have their own "frequency" distribution.
- (g) According to Working / Output:
- Deterministic System: 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.
- Probabilistic System: The probabilistic system can be described in terms of probable behavior, but, a certain degree of error is always attached to the prediction. Where a set of instructions given to a human who, for a variety of reasons, may not follow the instructions exactly as given. Forecasting is also a Probabilistic System.
- (h) 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. The categories of end users are:
- (i) Casual end users
 - (ii) Naive or parametric end users
 - (iii) Sophisticated end users
 - (iv) Stand-alone users
- (i) Table is re-drawn accurately:
- | Levels of Management | Focus |
|------------------------|-----------------------|
| Top Management | Strategic Planning |
| Middle Management | Resource Management |
| Operational Management | Day-to-day activities |
- (j) Enterprise Resource Planning (ERP) and Business Process Re-engineering (BPR) both relate to radical redesign of an organization at a relatively short period. Both are having the primary intend to optimize workflow and improve productivity. But, the chicken and egg question remained, whether an organization reengineer business process before implementing ERP or directly implement ERP and reengineer by adopting standard business process, included in the ERP package.

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2. Answer any three questions.

16x3=48

- (a) (i) A work sampling study was performed on the activities of the customer care executives in a service organization. The observations are as under?

Activity	No. of observations
A1	250
A2	60
A3	100
A4	160
A5	50
A6	60
A7	50
A8	70
Total	800

The management of the organisation plans to eliminate activity “A4” by acquiring an EDP system. This, it is felt, will enable the executives’ time to be better utilised. While the executives’ salary on an average is ₹ 4,000 per month (25 working days), the volume of their time utilised (i.e., for more customer-care) is put at three times what their salary reflects. There are 200 executives in the organization and the EDP system is going to cost ₹ 75,000 a month covering the initial investment as well as operation expenses. Should the organisation go in for the EDP system? 6

- (ii) A firm is using a machine whose purchase price is ₹ 15,000. The installation charges amount to ₹ 3,500 and the machine has a scrap value of only ₹ 1,500 because the firm has a monopoly of this type of work. The maintenance cost in various years is given in the following table:

Year	1	2	3	4	5	6	7	8	9
Maintenance Cost (₹)	260	760	1100	1600	2200	3000	4100	4900	6100

The firm wants to determine after how many years should the machine be replaced on economic considerations, assuming that the machine replacement can be done only at the year end. 5

- (iii) What is TQC and what are its principles? 5

Answer:

- (a) (i) As per the work sampling data, 160 out of a total of 800 observations are made for the activity, ‘A4’ – i.e., the latter activity occupies 160/800 fraction of an executive’s time. This mean $160/800 \times (4,000)$ is being spent monthly per executive on doing activity A4. For 200 executives, this amount works out to = $160 / 800 \times (4,000) \times (200) = ₹ 1,60,000$.

Notably this expenditure exceeds the amount that would be spent on the EDP system. Thus, if the number of executives could be reduced proportionate to the elimination of activity A4 done by them, the EDP system can be installed. This approach considers the employment of executives as ‘necessary expenditure’.

Another approach would be to look at the executives’ contribution to customer-care. If 160/800 fraction of the time is released for additional customer-care, the contribution in this area would be equivalent to: $(160/800) \times 3 \times 4000 \times (200) = ₹ 4,80,000$.

(Fraction of time additionally available $\times 3 \times$ (Rupee Value) \times (Number of executives). This, again, argues in favour of installing the EDP system.

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(ii) Cost of machine, $C = ₹ 15,000 + ₹ 3,500 = ₹ 18,500$

Scrap value, $S = ₹ 1,500$.

Year	Maintenance Cost, M_1 (₹)	Cumulative Maintenance Cost, ΣM_1 (₹)	$C - S$ (₹)	Total Cost $T_{(n)}$ (₹)	Annual Cost $A_{(n)}$ (₹)
(i)	(ii)	(iii)	(iv)	(v) = (iii)+(iv)	(vi) = (v)/n
1	260	260	17,000	17,260	17,260
2	760	1,020	17,000	18,020	9,010
3	1,100	2,120	17,000	19,120	6,373
4	1,600	3,720	17,000	20,720	5,180
5	2,200	5,920	17,000	22,920	4,584
6	3,000	8,920	17,000	25,920	4,320
7	4,100	13,020	17,000	30,020	4,288*
8	4,900	17,920	17,000	34,920	4,365
9	6,100	24,020	17,000	41,020	4,557

Lowest average cost is ₹ 4,288 approx., which corresponds to $n = 7$ in above table. Thus machine needs to be replaced every 7th year.

(iii) TQC is Total Quality Control.

It is quality control and improvement from shop floors to board rooms. It is an effective system for integrating quality development, quality maintenance and quality improvement efforts of various groups in an organization.

Principles of Total Quality Control (TQC)

- (1) Top management policies – Zero defects, continuous improvement etc.
- (2) Quality control training for everyone.
- (3) Quality at product/service design stage.
- (4) Quality materials from suppliers.
- (5) Quality control in production (SQC).
- (6) Quality-control in distribution, installation and usage.

(b) (i) Give the meaning of following process flowchart symbols:?

2

- (a)  (b) 

(ii) 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 (a) Processing time needed in hours to produce products A, B and C, (b) Annual production capacity of one machine in standard hours, and (c) Number of machines required. **3+2+2=7**

(iii) What are the objectives of maintenance management?

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Answer:

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(b) (i) The meaning of following process flowchart symbols:

(a)  Tasks or Operations

(b)  Storage Areas or Queues (waiting lines)

(ii) (a) 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	$325 \times 5 = 1,625$
B	450	4.0	$450 \times 4 = 1,800$
C	550	6.0	$550 \times 6 = 3,300$
			Total = 6,725 hrs.

(b) Annual production capacity of one machine in standard hours = $8 \times 288 = 2,304$ hours per year.

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

(iii) **The following are some of the objectives of Maintenance management:**

- (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.

(c) (i) **“The design of product crucial to success in to-day’s global competition”. Justify the statement by providing the features of an excellent product design.** 5

(ii) **What do you mean by ‘layout’ in a production planning system? Name the various types of layout.** 1+5=6

(iii) **As a Consultant what would be your suggestions to a Production Manager for managing technological changes?** 5

Answer:

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- (c) (i) A good product design can improve the marketability of a product by making it easier to operate or use, upgrading its quality, improving its appearance, and/or reducing manufacturing costs.

A distinctive design may be the only feature that significantly differentiates a product. An excellent design includes usability, aesthetics, reliability, functionality innovation and appropriateness. An **excellent design** provides competitive advantage to the manufacturer, by ensuring appropriate quality, reasonable cost and the expected product features. Firms of tomorrow will definitely compete not on price and quality, but on product design.

- (ii) A layout essentially refers to the arranging and grouping of machines which are meant to produce goods. Grouping is done on different lines. The choice of a particular line depends on several factors.

The methods of grouping or the types of layout are:

- (a) Process layout;
- (b) Product layout;
- (c) Fixed position layout;
- (d) Cellular Manufacturing (CM) layout;
- (e) A combination of the above.

- (iii) Some of the suggestions to production managers on how to manage changes in production technology and how to manage the implementation of major automation projects are given below:

- (i) Have a master plan for automation.
- (ii) Recognize the risks in going for automation.
- (iii) Establish a new production technology or technology development department.
- (iv) Allow plenty of time for the completion of automation projects.
- (v) Do not try to automate everything at once.
- (vi) People are the key to the successful implementation of automation projects.
- (vii) Companies moving too slowly in adopting new production technology may be left behind others.

- (d) (i) **How do you distinguish among Product Design, Process Design and Production Design?** **3**

- (ii) **With reference to Time Study, define the terms (a) Relaxation Allowance, (b) Contingency Allowance, (c) Process Allowance by providing appropriate examples.** **2×3=6**

- (iii) **Write a line to define the following terms with reference to measuring productivity:** **1×7=7**

- | | |
|---------------------------|-------------------------|
| (a) Validity, | (b) Completeness, |
| (c) Compatibility, | (d) Inclusiveness, |
| (e) Timeliness, | (f) Cost effectiveness, |
| (g) Partial productivity. | |

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Answer:

(d) (i) Product Design, Process Design and Production Design

Product Design: One way for manufacturers to satisfy customers and gain a differential advantage is through product design which refers to the arrangement of elements that collectively form a good or service.

Process design is concerned with the overall sequences of operations required to achieve the design specifications of the product. It specifies the type of work stations that are to be used, the machines and equipments necessary to carry out the processes to produce the product.

Production Design: The design of products and services is partially dependent on the production system design and vice versa. A product or service designed in one way may be costly to produce, but it may be somewhat less costly when designed another way. The concept of designing products from the point of view of producibility is known as production design.

(ii) (a) Relaxation Allowance (RA): This is also known as personal, fatigue or delay allowance (PFD allowance). This allowance is given to the work to overcome the fatigue due to physical exertion, posture, concentration, working condition and personal needs such as going to toilet, drinking water, attending phone calls etc., it usually varies from 10% to 20% of normal or basic time.

(b) Contingency Allowance (CA): This allowance is given for infrequent or non-repetitive activities such as obtaining special materials from stores, sharpening of tools, getting a special tool from the tool stores, and consultation with the supervisor. It is usually about 5% of normal or basic time.

(c) Process Allowance: Allowance given to the worker to compensate himself for enforced idleness due to the nature of a process or operation e.g., working on automatic machine, electroplating etc., during which the worker is forced to be idle during a part of the work cycle.

(iii) (a) Validity: It reflects accurately the changes in productivity.

(b) Completeness: It takes into consideration all components of both the output and the input for a given productivity ratio.

(c) Comparability: It enables the accurate measurement of a productivity change between periods.

(d) Inclusiveness: It takes into account and measures separately the productivity of all activities.

(e) Timeliness: It ensures that data is provided soon enough for managerial action to be taken when problems arise.

(f) Cost effectiveness: It obtains measurement in a manner that will cause the least interruption possible to the ongoing productive efforts of the firm.

(g) Partial Productivity: This measures productivity of one factor or input, keeping other factors or inputs constant or unchanged.

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3. Answer any two questions:

16×2=32

(a) (i) From the following two relations of X and Y, find $X \cup Y$.

3

RELATION X	
R No.	OCCUPATION
30	BUSINESS
42	BUSINESS
43	STUDENT
48	BUSINESS

RELATION Y	
R No.	OCCUPATION
42	BUSINESS
48	BUSINESS
57	STUDENT
65	STUDENT

(ii) List the activities involved in the Information System Department.

3

(iii) List the tangible benefits of ERP. Write a line to clarify 'configuration' in ERP system.

5+1=6

(iv) "One of the important factors of success for MIS is quality of software." List the criteria for software selection.

4

Answer:

(a) (i) Solution: $X \cup Y =$

R. NO.	OCCUPATION
30	BUSINESS
42	BUSINESS
43	STUDENT
48	BUSINESS
57	STUDENT
65	STUDENT

(ii) Activities involved in the Information System Department are:

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

(iii) 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, there by minimizing shortages, interruption and rework.
- (5) Reduction in the cost of after sales services.

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Configuration: 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.

(iv) Criteria for selection of software:

- Compatibility of hardware
- Capable of taking load of data volume
- Have the support of software for required database
- Capable of supporting the communication network
- Satisfy the design specification of system architecture – Central data processing or distributed.

(b) (i) Define “Secure System” under Section 2 of the Information Technology Act, 2000.4

(ii) Distinguish between on-line business and conventional business. 4

(iii) List main goals of E-Commerce. 3

(iv) List the implications of database approach and write one line on each point. 5

Answer:

(b) (i) “Secure system” under Section 2 of the Information Technology Act, 2000 means computer hardware, software and procedure that

- Are reasonably secure from unauthorized access and misuse.
- Provide a reasonable level of reliability and correct operation.
- Are reasonably suited to performing the intended function and
- Adhere to generally accepted security procedures.

(ii) Online business is different from conventional business. Business done through computer and internet is known as online business and such business may be operated from a business office or home office but its primary existence is in cyber space. It is different from conventional business where in-person contact between customer and product/service provider is essential. Practically an online based business could be operated from anywhere by someone using a computer to assess and maintaining a site which is hosted by an independent ISP as there are many types of traditional businesses. Therefore, there are different types of virtual businesses. However, in virtual business, the primary communication between business operator and potential customer is done online.

(iii) E-commerce helps in achieving following goals:

- (a) Reach new markets.
- (b) Create new products or services.
- (c) Build customer loyalty.
- (d) Enrich human capital.
- (e) Make the best use of existing and emerging technologies.
- (f) Achieve market leadership and competitive advantage.

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(iv) Implications of the Database Approach:

- (a) 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 co-operation 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.
- (b) 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.
- (c) 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.
- (d) 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.
- (e) Economics 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.

(c) (i) Expand CASE. What is its role? Write a line on each CASE tool to clarify its function.

1+1+4=6

(ii) List the needs of integration of information. Name the major output from financial and costing sub-system of an information system.

2+5=7

(iii) List the areas of responsibilities of Database Administrator.

3

Answer:

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(c) (i) The full form of CASE is Computer-Aided-Software Engineering.

It refers to the automation of anything that humans do to develop systems and support virtually all phases of traditional system development process. These can be used to create internally requirements specifications with graphic generators and using of specifications languages. The various CASE tools are screen generator, menu generator, report generator and code generator.

- Layout form and Screen Generator: They are for printed report used to format or paint the desired layouts.
- Menu Generator: Menu generator outlines the functions.
- Report Generator: it indicates totals, paging, sequencing and control breaks in creating samples of the desired report.
- Code Generator: It allows the analyst to generate modular units of source code.

(ii) The following are the needs of integration of information:

- Information for various inter-related parameters provides clear picture.
- Comprehensive review of business situation is possible.
- Disjoint information may have serious gaps.
- Redundancy of information is avoided by scientific linking.
- Cross functional impacts in the business is assessed.

Financial Accounting and Costing system output:

- General Ledger
- Cash & Bank Book
- Subsidiary Ledgers
- Purchase Day Book
- Sales Day Book
- Accounts Receivable
- Accounts Payable
- Fixed Asset Accounting
- Cost Accounting
- Trial Balance
- Profit & Loss Statement (monthly/quarterly/yearly)
- Balance Sheet (monthly/quarterly/yearly)

(iii) Areas of responsibilities of Database Administrator:

- Database Management
- Database Library Management
- Security of Data