INTERMEDIATE EXAMINATION
GROUP II
(SYLLABUS 2012)

SUGGESTED ANSWERS TO QUESTIONS

DECEMBER 2014

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 working 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) What is process planning? 2

(b) List the major phases in production planning and control function. 2

(c) Expand TQC and define the term. 2

(d) What is meant by 'Total' in Total Productive Maintenance? 2

(e) A worker is employed for 10 hours. During this period he takes 9 hours to complete a job with the standard time of 8 hours. Calculate the productivity of the worker as a percentage. 2

(f) What is measured by regression analysis? 2

(g) Expand RDBMS. What is the additional condition added in RDBMS over DBMS? 2

(h) What are the characteristics of Good Quality Information? 2

(i) What is meant by 'key pair' under the Information Technology Act, 2000? 2

(j) What do you mean by 'configuration of an ERP system'? 2

Answer: 1.

(a) Process planning is concerned with planning the conversion processes needed to convert the raw material into finished products.

(b) The major phases in production planning and control function:

(1) Planning Phase, (2) Action Phase, and (3) Control Phase.

(c) TQC is Total Quality Control. It is an effective system for integrating quality development, quality maintenance and quality improvement efforts of various groups in an organisation.

(d) Total in "Total Production Maintenance" means:

(i) Total employee involvement,

(ii) Total equipment effectiveness (i.e., Zero breakdown) and

(iii) Total maintenance delivery system.

(e) Productivity = $\frac{\text{Standard hours of ouput}}{\text{Clock time scheduled}} = \frac{8}{10} \times 100 = 80\%$

(f) Regression analysis identifies the movement of two or more interrelated series.

It is used to measure the changes in a variable (dependent variable) as a result of changes in Other variables (independent variables).

(g) RDBMS, when expanded, means Relational Data Base Management System RDBMS adds the additional condition over DBMS that the system supports a tabular structure for the data, with enforced relationships between the tables.

(h) The characteristics of good quality information: it should be:

- Accurate
- Up-to-date
- Relevant
- Complete
- On-time
- Appropriately presented
- Intelligible

(i) "Key pair", in an asymmetric crypto system, means a private key and its mathematically Related public key, which are so related that the public key can verify a digital signature created by the private key.

(j) 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. First thing to happen is to install specific modules needed and configuring these modules, as per the scope of the project.

2. Answer *any three* questions. 16x3=48

(a) (i) What are the benefits of preventive maintenance? 4

(ii) What is the main objective of Time Study? List other objectives also. 2+3=5

(iii) Location A would result in annual fixed costs of ₹ 3,50,000 variable costs of ₹ 63 per unit and revenues ₹ 70 per unit. Annual fixed costs at Location B are ₹7,70,000 variable costs are ₹ 32 per unit and revenues are ₹ 65 per unit.

Sales volume is estimated to be 30,000 units/year. Calculate BEP for each location and determine which location will be attractive. 3+4=7

(b) (i) What are the criteria for plant location domestically or internationally? After deciding on a country, what are the considerations for selection of a region out of many? 2+4=6

(ii) Define Capital Spares and Rotable Spares. 4

(iii) The following data on the exports of an item by a company during the various years fit a straight line, (for the time being, assume that a straight line gives a good fit). Give a forecast for the years 2014 and 2015. 6

Year	No. of items ('000)
2005	15
2006	20
2007	25
2008	28
2009	30
2010	35
2011	35
2012	40
2013	45

(c) (i) The data on the operating costs per year and resale prices of equipment X whose purchase price is ₹15,000 are given below:

Year	1	2	3	4	5	6	7
Operating Cost (₹)	1,000	1,600	2,200	2,500	3,500	5,000	6,000
Resale Value (₹)	10,000	8,000	6,000	4,000	2,000	1,000	500

(a) What is the optimum period for replacement?

(b) When equipment X is 2 years old, equipment Y, which is new model for the same usage, becomes available in the market. The replacement period is 3 years with an average cost of ₹4500. Should we replace equipment X by new model of equipment Y? If so, when is it to be replaced? 8

(ii) What are the two directions of vertical integration? State the advantages and disadvantages of vertical integration. 4+4=8

(d) (i) What is the basic step in formulating L.P. problem? Mention the situations where L.P. technique can be fruitfully applied. 2+3=5

(ii) The following data are available for a manufacturing unit:

No. of operators	**20**
Daily working hours	**8**
No. of days per month	**26**
Std. production per month	**300 units**
Std. Labour hours per unit	**8**

The following information was obtained for June 2014:

Man days lost due to absenteeism	**29**
Unit produced	**230**
Idle Time	**280 man hours**

(iii) You are required to calculate the following: 2x4=8

(a) Percent absenteeism

(b) Efficiency of utilisation of labour

(c) Productive efficiency of labour

(d) Overall productivity of labour in terms of units produced per man per month.

(iii) "A good productivity measure should possess certain properties." State these properties which contribute towards improving productivity. 3

Answer: 2. (a)

(i) Benefits of Preventive Maintenance include (a) greater safety for workers, (b) decreased production downtime, (c) fewer large scale and repetitive repairs, (d) less cost for simple repairs made before breakdown, (e) less standby equipment required, (f) better spare parts control, (g) identification of items with high maintenance costs, and (h) lower unit cost of manufacture.

(ii) The main objective of Time Study is "to determine by direct observation, the quantity of human work in a specified task and hence to establish the standard time, within which an average worker working at a normal pace should complete the task using a specified method".

The other objectives are:

(a) To furnish a basis of comparison for determining operating effectiveness.

(b) To set labour standard for satisfactory performance.

(c) To compare alternative methods in method study in order to select the best method.

(d) To determine standard costs.

(e) To determine equipment and labour requirements.

(f) To determine basic times/normal times.

(g) To determine the number of machines an operator can handle.

(h) To balance the work of operators in production or assembly lines.

(i) To provide a basis for setting piece rate or incentive wages.

(j) To set the completion schedules for individual operations or jobs.

(k) To determine the cycle time for completion of a job.

(iii) $$BEP = \frac{\text{Fixed Cost}}{\text{Revenue - Variable cost}}$$

Location A BEP (units) = $\frac{₹3,50,000}{₹(70 - 63)}$ = 50,000 units.

Location B BEP (units) = $\frac{₹7,70,000}{₹(65 - 32)}$ = 23,333 units.

At the expected demand of 30,000 units, profits (loss) for the alternatives are:

Alternatives	A	B
Revenue ₹	21,00,000	19,50,000
Costs:		
Variable ₹	18,90,000	9,60,000
Fixed ₹	3,50,000	7,70,000
	22,40,000	17,30,000
Profit / (Loss) ₹	(1,40,000)	2,20,000

Location B is most attractive, even though annual fixed costs are much higher than A.

(b) (i) **Deciding on Domestic or International Location:**

The first step in plant location is to decide whether the facility should be located domestically or internationally. A few years ago, this factor would have received little consideration. But with increasing internationalisation of business, the issue of home or foreign country is gaining greater relevance. If the management decides on foreign location, the next logical step would be to decide upon a particular country for location. This is necessary because, countries across the world are varying with each other to attract foreign investment. The choice of a particular country depends on such factors as political stability, export and import quotas, currency and exchange rates, cultural and economic peculiarities, and natural or physical conditions.

The selection of Region

The selection of a particular region out of the many natural regions of a country is the second step in plant location.

The following factors influence such selection:

(1) Availability of Raw Materials

(2) Nearness to the Market

(3) Availability of Power

(4) Transport Facilities

(5) Suitability of Climate

(6) Government Policy

(ii) **Capital Spares:** A few—say five or ten—of these spares are required, over the lifetime of an equipment. These spares are expensive and therefore it would be

desirable to keep only as many as would be required from the viewpoint of service level. This decision is guided by the probability that a certain number of them are required over the life of the equipment.

Rotable Spares: These are repairable and re-usable spares, such as a jet engine or an electric motor which can be reconditioned after failure and put back in operation. This situation can be visualised in a Multiple Channel Single Service Queueing theory format, where the defective equipments are the arrivals and the spares are the servers. The service times are given by the distribution of time to recondition a spare.

The inter-arrival times of the defective items can also be modelled in terms of a probability distribution.

(iii) We can call the years as 'X' and exports as 'Y'. In order to use the normal equations for the least square line, we need $\sum X$, $\sum Y$, $\sum XY$ and $\sum X^2$. If we arrange X in such a way that $\sum X = 0$, it will simplify our calculations.

Therefore, we call the year 2009 as 0, 2008 as -1 and 2010 as + 1 and likewise for the other years in the data.

The rearrangement is shown in the table as follows:

X	Y	X^2	XY
-4	15	16	-60
-3	20	9	-60
-2	25	4	-50
-1	28	1	-28
0	30	0	0
1	35	1	35
2	35	4	70
3	40	9	120
4	45	16	180
$\sum X = 0$	$\sum Y = 273$	$\sum X^2 = 60$	$\sum XY = 207$

The normal equations are:

$\sum Y = a_0 N + a_1 \sum X$

$\sum XY = a_0 \sum X + a_1 \sum X^2$

As $\sum X = 0$ and $\sum Y = a_0 N$ and $\sum XY = a_1 \sum X^2$

Therefore,

$a_0 = \sum Y / N = 273/9 = 30.33$

$a_1 = \sum XY / \sum X^2 = 207 / 60 = 3.45$

The equation of a straight line fitting the data is:

$Y = 30.33 + 3.45X$

(a) Forecast for 2014, (i.e., X = 5): Y = 30.33 + 3.45 (5) = 47.58 ('000)

(b) Forecast for 2015, (i.e., X = 6): Y = 30.33 + 3.45 (6) = 51.03 ('000)

(c) (i) (a) The determination of the optimal period of replacement of equipment X is given in Table below.

Table: Determination of Optimal Replacement Period

Year	M_1 ₹	Cum. M_1 ₹	Net Capital Cost C – S ₹	Total Cost T(n) ₹	Average Cost A(n) ₹
1	1000	1000	5000	6000	6000
2	1600	2600	7000	9600	4800
3	2200	4800	9000	13800	4600
4	2500	7300	11000	18300	4575
5	3500	10800	13000	23800	4760
6	5000	15800	14000	29800	4967
7	6000	21800	14500	36300	5186

Since the average cost corresponding to the 4-yearly period is the least, the optimal period for replacement = 4 years.

(b) As the minimum average cost for equipment Y is smaller than that for equipment X, it is prudent to change the equipment. To decide the time of change, we would determine the cost of keeping the equipment in its 3rd, 4th and 5th year of life and compare each of these values with 4,500 (the average cost for equipment Y). The equipment X shall be held as long as the marginal cost of holding it would be smaller than the minimum average cost for equipment Y. The calculations are given here:

Year	Operating Cost ₹	Depreciation ₹	Total Cost ₹
3	2200	8000 - 6000 = 2000	4200
4	2500	6000 - 4000 = 2000	4500
5	3500	4000 - 2000 = 2000	5500

Since the cost incurred in keeping the equipment X in the third and the fourth year is less than or equal to the average cost for equipment Y, the replacement should be done after 2 years.

(ii) Two directions of vertical integration are (a) Backward integration which represents moving upstream toward the sources of raw materials and parts, for example a steel mill going for backward integration by owning iron ore and coal mines and a large fleet of transport vehicles to move these raw materials to the steel plant, (b) Forward integration in which the firm acquires the channel of distribution (such as having its own warehouses, and retail outlets).

Advantages of vertical integration are:

(a) Can sometimes increase market share and allow the firm enter foreign markets more easily.

(b) Can achieve savings in production cost and produce higher quality goods.

(c) Can achieve more timely delivery.

(d) Better utilisation of all types of resources.

Disadvantages of vertical integration are:

(a) Not attractive for low volumes.

(b) High capital investment and operating costs.

(c) Less ability to react more quickly to changes in customer demands, competitive actions and new techniques.

(d) (i) In formulating the linear programming problem, the basic step is to set up some mathematical model. For this purpose, the following considerations should be kept in mind: (i) unknown variables, (ii) objectives and (iii) constraints.

Application: The linear programming technique may be fruitfully applied in the following spheres:

(a) The linear programming can be used in production scheduling and inventory control so as to produce the maximum out of the resources available to satisfy the needs of the public by minimising the cost of production and the cost of inventory control.

(b) The technique of linear programming can also be fruitfully used in solving the blending problems. Where basic components are combined to produce a product that has certain set of specifications and one may calculate the best possible combination of these compounds which maximise the profits or minimise the costs.

(c) Other important applications of linear programming can be in purchasing, routing, assignment and other problems having selection problems such as(a) selecting the location of plant, (b) deciding the transportation route within the organisation, (c) utilising the godowns and other distribution centres to the maximum, (d) preparing low-cost production schedules, (e) determining the most profitable product-mix, and (f) analysing the effects of changes in purchase prices and sale prices.

(ii) No. of days per month = 26

Daily working hrs. = 8

No. of operators = 20

No. of Man days = 20 x 26 = 520 Man days.

Total working hrs. = 520 × 8 = 4160

Hours lost in absenteeism = 29 x 8 = 232

(a) Percent absenteeism = $\frac{232 \text{ hrs.} \times 100}{4160 \text{ hrs.}} = 5.6\%$

(b) Efficiency of utilisation of labour

$$\frac{\text{Standard labour hour to produce 230 units}}{\text{Total labour hours}}$$

$$= \frac{230 \times 8 \times 100}{4160} = 44.2\%$$

(c) Standard time required to produce 230units = 230 x 8 = 1840 labour-hours.

In June, man hours lost = 29 x 8 = 232

" " idle time = 280

Total loss of time = 232+280 = 512 hours.

Productive hours available in June = 4160

Less: Total loss of time = 512

Actual labour-hours = 3648

Efficiency of labour = $\frac{\text{Std. Labour hrs.}}{\text{Actual Labour hrs.}} = \frac{1840 \times 100}{3648}$ = 50.4%

(d) 20 men produce 300 units,

Std. labour productivity = 300 / 20 = 15 units.

In June, overall productivity = 230 / 20 = 11.5 units i.e. productivity falls by 23.3%.

(iii) Useful properties for improving productivity:

(1) Validity: it reflects accurately the changes in productivity.

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

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

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

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

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

3. Answer any two questions: 16×2=32

(a) (i) Explain the various phases of System Development Life Cycle 6

(ii) From the following two relations of X and Y, find X UY: 4

Relation X	
Batch No.	**Course**
1	**BCOM**
2	**BA**
3	**BSC**

Relation Y	
Batch No.	**Course**
1	**BCOM**
2	**BA**
3	**BSC**
4	**MA**
5	**MCOM**
6	**MSC**

(iii) Why do the managers need information support for decision-making? List the components of Business Information System. 3+3=6

(b) (i) Discuss about legal aspect of 'Cyber Crime'. 3

(ii) What are the stages through which the software program has to pass during its development? 3

(iii) "There are various "Do's" and "Don'ts" effecting successes or failures of an ERP implementation." Mention four critical success factors and four critical failure factors. What is the system environment needed? 4+4+2=10

(c) (i) What are the main goals of E-commerce? 3

(ii) Expand the following terms and state the role played by each of the software in the Information System: 3+3=6

(a) OLTP and

(b) OLAP

(iii) Define the terms 'Asymmetric Crypto System' and 'Digital Signature' under the Information Technology Act, 2000. 2+2=4

(iv) What is the safeguard against hardware or software failure in DBMS? 3

Answer: 3. (a)

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

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

(i) Request clarification

(ii) Feasibility study

(iii) Request approval

(2) Requirements analysis or systems analysis:

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

(3) Design of the system:

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

(4) Acquisition and development of software:

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

(5) System testing:

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

(6) Implementation and maintenance:

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

(ii)

Relation X U Y	
Batch No.	Course
1	BCOM
2	BA
3	BSC
4	MA
5	MCOM
6	MSC

(iii) The managers need information support for decision making. The business activities have become more complex and competition has become more acute. For survival, the decision making process must be accurate and at right time. For this, information base for decision making plays a great role. Development in Information Technology have created a new era in management decision making process. The decision making has become increasingly difficult due to following change in the business environment:

- Increase in the number of alternatives to be evaluated
- Increase in risk in business
- Complex decision making environment
- Time pressure
- High cost of making wrong decisions

Components of Business Information System

Business Information System comprises of:

(a) Transaction Processing System

(b) Management Information System

(c) Expert System

(d) Decision Support System

(e) Executive Information System

3. (b) (i) Legal aspect of Cyber Crime

Cyber Crime is not defined in Information Technology Act 2000 or in the I.T.

Amendment Act 2008 or in any other legislation in India. In fact, it cannot be too.

Offence or crime has been dealt with elaborately listing various acts and the punishments for each, under the Indian Penal Code, 1860 and quite a few other legislations too. In a cyber crime, computer or the data itself the target or the object of offence or a tool in committing some other offence, providing the necessary inputs for that offence.

All such acts of crime will come under the broader definition of cyber crime. The United Nations Commission on International Trade Law (UNCITRAL) adopted a Model Law on e-commerce, providing for equal treatment of users of electronic communication and paper-based communication. All members of United Nations are required to consider the Model Law in their respective countries.
In India, the legislation seeking to grant recognition and legal infrastructure to e-commerce is The Information Technology Act, 2000.

(ii) Stages through which the software program has to pass during its development:

(a) Program Analysis

(b) Program design

(c) Program coding

(d) Debug the program

(e) Program documentation

(f) Program maintenance

(iii) **Critical success factors,** needing focused initiative, are appended below:

- **Commitment from project sponsor:** Project sponsors normally belong to top echelon of the organization. A deep commitment and active involvement is needed from them and bare monitoring and oversight may not suffice. Their vigorous engagement should get other executives in board. One of their important roles will be to resolve any inter departmental conflict which is bound to occur during the course of implementation. They should also ensure that most knowledgeable executives are engaged in the project and released from routine functions whenever needed.

  • **Commitment of resources:** An ERP project needs a significant financial commitment and budgetary support. Expenditure involves not only direct expenditure relating to ERP package but a host of indirect cost such as integration with other software, gathering and cleaning of input data, archiving data from legacy system, engaging expert/consultant, additional support need, provision for contingency etc.

- **Selection of package and consultant:** The selection of ERP package should be absolutely need based, as detailed on business requirement analysis, done beforehand. Selection should not be influenced by extraneous factors such as glamour involved in the name of big ERP packages. Selection of a consultant, who will provide advice independent of the interest of vendor guide the entire process of implementation, should be done carefully and with due diligence. The consultant should be truthfully independent and should not be linked to a particular ERP vendor. This is also applicable to consultants from big named

consulting firms as they may have tendency to recommend a complex product, requiring added consulting effort during implementation process.

- **Project Management:** An empowered project manager, supported by IT and functional experts and appropriate project management methodology, is key to success of ERP implementation. Setting up of project team, resource allocation, milestones and deliverables etc. form important part of project management. Tailor made training programme for different type of users and a predefined change management process, are also crucial.
- **Legacy Data:** Legacy data are stored manually, in excel files or in legacy system. Collection of legacy data is needed to be planned carefully to avoid the syndrome known as "garbage in and garbage out" which will undermine the confidence on the system after implementation. Cleaning of data should be done by removing duplicate and unnecessary information, before importing to ERP system.

Critical failure factors: Critical factors for failure may be defined as contrary to critical success factors. Some specific concerns of failures are mentioned below:

- **Creeping in of additional functionality:** Pressure often mounts for additional functionalities not envisaged earlier during implementation. This may lead to conflict with ERP vendor. Dealing through change management process also involves additional cost and time and should be avoided as far as possible.
- **Unrealistic expectations:** ERP system is not an all cure silver bullet. Users often like to see an immediate improvement after installation. There are bound to be initial period of frustration which may snowball, undermining confidence on the system.
- **Information overload:** An ERP system contains hundreds of reports and queries. Too much information creates a lot of confusion amongst users. Notwithstanding information overload, many a time, users feel cheated as the system fail to generate identical reports to which they are accustomed.
- **Resistance to Change:** Users are overwhelmed by all the new features of the system. Some of the aged employees may be unwilling to adopt a new way of working. Some may be uncomfortable with the awareness that their supervisor will now keep a better trail on what they are doing.

Environment of ERP Implementation

Any ERP implementation requires an appropriate Operating System (OS) and Relational Database Management (RDBMS) for hosting the system. Networking issues also assumes importance particularly when the system is rolled out at different locations. Additionally, licensing options associated with ERP packages need to be carefully evaluated during final contract negotiation.

3. (c) (i) Main Goals of E-commerce:

It 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.

(ii) OLTP means On-line Transaction Processing.

On-line transaction processing is carried in a client/server system. In todays competitive environment, information at right time plays a great role in controlling costs of various resources and providing best possible services to the customers. In other words, business environment has been characterized by growing competition, shrinking cycle time and accelerating pace of technological innovations and companies have to focus on better information management. Better information means right information at right time. OLTP are being adopted in wider scale to have the following advantages:

- It can serve multiple users at a point of time
- Technology serves the facilities to collect information from multi-locations
- High flexibility in information processing etc.

OLAP indicates On-line Analytical Processing

An OLAP software does the analysis of information from data warehouse. The OLAP applications are widely scattered in divergent application area like Finance Management, Sales Analysis. The real test of an OLAP system is inefficient use of data from databases and computational capability of data to develop model establishing the relationship of various parameters. In fact, it provides the services of 'just-in-time' information.

Though OLAP software are found in widely divergent functional areas, they have three common key features which are:

- Multidimensional views of data
- High analytical ability
- 'Just-in-time' information delivery

(iii) The Information Technology Act, 2000, under Section 2, defines the terms as under:

"**Asymmetric Crypto System**" means a system of a secure key pair consisting of a private key for creating a digital signature and a public key to verify the digital signature.

"**Digital Signature**" means authentication of any electronic record by a subscriber by means of an electronic method or procedure in accordance with the provisions of Section 3.

(iv) Safeguard against hardware or software failure in DBMS:

A DBMS must provide facilities for recovering from hardware or software failures. The **backup and recovery subsystem** of the DBMS is responsible for recovery. For example, if the computer system fails in the middle of a complex update program, the recovery subsystem is responsible for making sure that the database is restored to the state it was in before the program started executing. Alternatively, the

recovery subsystem could ensure that the program is resumed from the point at which it was interrupted so that its full effect is recorded in the database.