INTERMEDIATE EXAMINATION

GROUP II

(SYLLABUS 2012)

SUGGESTED ANSWERS TO QUESTIONS

DECEMBER 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. 2×10=20

(a) Identify four principal functions of an operating system with reference to Operation Management.

(b) List the various elements of the framework for Project Management Issues.

(c) Categorise spare parts for stocking policy analysis under Spare Parts Management.

(d) Define Quality Triology under Total Quality Management.

(e) State the formula for maintenance cost index (as a percentage) to measure maintenance effectiveness.

(f) An analyst wants to obtain a cycle time estimate that is within ± 5% of the true value. A preliminary run of 20 cycles took 40 minutes to complete and had a calculated standard deviation of 0.3 minutes. Calculate the coefficient of variation to be used for computing the sample size for the forthcoming time study.

(g) Distinguish between 'Private Key' and 'Public Key'.

(h) Explain the term 'rescue maintenance' under System Maintenance.

(i) Identify different functions commonly performed by Database System Utilities.

(j) Identify characteristics of a good quality information.

Answer:

1. (a) Four principal functions of an operating system with reference to Operation Management are:

(i) Manufacture

(ii) Transport

(iii) Supply

(iv) Service

(b) The various elements of the framework for Project Management Issues are listed below:

1. Strategy
2. Structure
3. Systems
4. Staff
5. Skills
6. Style /Culture
7. Stakeholders

(c) For stocking policy analysis under Spare Parts Management, the spare parts may be categorized as under:

1. Regular Spares (or maintenance spares or breakdown spares)
2. Insurance Spares
3. Capital Spares
4. Rotable Spares

(d) Quality Triology implies the following three sub-divisions:

(i) Quality planning

(ii) Quality control and

(iii) Quality improvement

(e) Maintenance cost index (as a percentage) = $\frac{(\text{Annual Maintenance Cost})}{(\text{Cost of Production})} \times 100$

(f) Standard deviation of sample (s) = 0.3 min/cycle

Mean of sample = $\bar{x}$ = (40 minutes)/ (20 cycles) = 2 minute /cycle

Co-efficient of variation (v)= $s / \bar{x}$ = 0.3/2 = 0.15

(g) "Private key" is the key of a key pair used to create a digital signature, whereas "Public key" is the key of a key pair used to verify a digital signature and listed in the Digital Signature Certificate.

(h) 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.

(i) 1. Loading

2. Backup
3. File reorganization
4. Performance monitoring

5. Other utilities for sorting files, handling data compression, monitoring access by users, and performing other functions.

(j) The characteristics of a good quality information:

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

2. Answer any three questions. 16×3=48

(a) (i) "Higher productivity has manifold advantages." State these advantages. 6

(ii) A faculty in a college is planned to rise to strength of 60 staff members and then to remain at that level. The wastage of recruits depends upon their length of service and is as follows: 3+4=7

Year	1	2	3	4	5	6	7	8	9	10
Total % who left up to end of year	6	36	57	66	71	77	81	87	96	100

(I) Find the number of staff members to be recruited every year.

(II) If there are seven posts of Head of Department for which length of service is the only criterion of promotion, what will be average length of service after which a new entrant should expect promotion?

(iii) State three major purposes of Materials Budget. 3

Answer:

(a) (i) Higher productivity has manifold advantages:

(1) To the Individual Concern

- Higher productivity means more wages directly to the piece-workers and more production bonus to all workers. It means satisfied staff and harmonious staff relations.
- The factory earns more profit because of the reduction in costs.
- Continuous higher productivity may induce the management to reduce selling prices so that sales and production may increase.

(2) To the Industry

- Higher productivity in some concerns will enable less efficient firms to follow them for their own survival.

(3) To the Government

- Higher profits earned by factories will bring more revenue to the government by taxation.
- Export trades may develop bringing more foreign exchange to the nation.
- Overall higher productivity will raise an all round standard of labour.

(ii) Let us assume that the recruitment per year is 100. From above it is clear that the 100 who join in the first year will become zero in 10th year, the 100 who join in the 2nd year will serve for 9 years and become 4 at the end of the 10th year and the 100 who join in the 3rd year will serve for 8 years and become 13 at the end of the 10th year and so on. Thus, when the equilibrium is attained, the distribution length of service of staff members will be as under:

Year	No. of Staff Members
0	100
1	94
2	64
3	43
4	34
5	29
6	23
7	19
8	13
9	4
10	0
TOTAL	423

(I) Thus if 100 staff members are recruited every year, the total number of staff members after 10 years of service = 423
To maintain a strength of 60, the number to be recruited every year = (100 / 423) × 60 = 14.18
It is assumed that those staff members who completed x years' service but left before x + 1 years' service, actually left immediately before completing x + 1 years.
If it is assumed that they left immediately after completing x years' service, the total number will become 423 - 100 = 323 and 100 the required intake will be 60 ×100/323 = 18.57
In actual practice they may leave at any time in the year so that reasonable number of recruitments = (14.18 + 18.57)/2 = 16.37 = 16 approx.

(II) If we recruit 16 persons every year then we want 7 seniors. Hence if we recruit 100 every year, we shall require (7 /16) × 100 = 44 (appox) seniors.
It can be seen that 44 seniors will be available if we promote them during 6th year of their service (0 + 4 + 13 + 19 + 23 = 59 > 44).

∴ The promotion of a newly recruited staff member will be due after completing 5 years and before putting in 6 years of service.

(iii) Three major purposes served by the materials budget are as follows:

- The financial resource availability is known exactly through materials budget provisions and hence the materials management department can plan its purchases and long term purchase contracts with suppliers optimally taking into consideration price trends, market position, trend in sales etc.

- The prices of materials based on which budgets are prepared and the actual prices at which materials are bought are compared. This helps in understanding the controllable and uncontrolled elements that cause the budget variance.

- ❖ The cash requirements for procuring materials can be clearly projected for the budgeted period (which is usually a year) and also for shorter time periods such as month or quarter in the planning horizon.

(b) (i) List the major areas and types of maintenance an organization may use in those areas. 4

(ii) Calculate the standard time per article produced form the following data obtained by a work sampling study: 7

Total No. of observations = 2597
No. of working observations = 2000
No. of units produced in 100 hours duration = 5000 numbers
Proportion of manual labour = ¾
Proportion of machine time = ¼
Observed rating factor = 120%
Total allowances = 15% of normal time

(iii) Define simulation and identify its four phases. 3+2=5

Answer:

(b) (i) Areas of maintenance

The major areas of maintenance are:
(1) Civil maintenance
(2) Mechanical maintenance
(3) Electrical maintenance

Types of maintenance: In all the above stated areas, organization may use any or all the five types of maintenance:
(a) Break down maintenance or corrective maintenance,
(b) Preventive maintenance,
(c) Predictive maintenance,
(d) Routine maintenance,
(e) Planned maintenance.

(ii) Actual working time in the duration of 100 hours = 100 × (2,000/2,597) = 77.01 hours
Time taken per article = (77.01 × 60) / 5,000 = 0.924 minute
Observed manual labour time per article = 0.924 × (3 / 4) = 0.693 minute
Observed machine time per article = 0.924 × (1 / 4) = 0.231 minute
Normal labour time per unit = Observed time / unit × Rating factor = 0.693 × 1.20 = 0.8316 minute
Standard labour time per unit = 0.8316+ (15 /100) × 0.8316 = 0.9563 minute
Standard time per unit of article produced = 0.9563 + 0.231 =1.19 minutes

(iii) In general terms, simulation involves developing a model of some real phenomenon and then performing experiments on the model evolved. It is a descriptive, and not optimizing technique. To simulate is to initiate. In simulation, a given system is copied and the constants associated with it are manipulated in that artificial environment to examine the behaviour of the system.
Broadly there are four phases of the simulation process:

(1) Definition of the problem and statement of objectives
(2) Construction of an appropriate model
(3) Experimentations with the model constructed
(4) Evaluations of the results of simulations.

(c) (i) Expand TPM. Identify various activities a TPM system is encompassed of, with influence on equipment up time. 1+4=5

(ii) Explain 'Eight Steps Benchmarking Process'. 6

(iii) Compute the productivity per machine hour with the following data. Also draw your interpretation. 5

Month	No. of machines employed	Working hours	Production Units
July	400	225	99,000
August	500	200	1,00,000
September	600	250	1,35,000

Answer:

(c) (i) The full form of TPM is Total Productive Maintenance.

TPM is a comprehensive system of equipment maintenance that encompasses all activities with an influence on equipment up time (i.e., working time). TPM aims at "Zero breakdown" or "Zero down time".

These activities are:

(1) Regulating basic conditions
(2) Adhering to proper operating procedures
(3) Restoring deterioration
(4) Improving weaknesses in design
(5) Improving operation and maintenance skills

(ii) Eight Steps benchmarking process

The Benchmarking process consists of three general activities: Planning, Analysis, and Integration/action.

Overall, the process follows the Plan-Do-Study-Act Cycle of all quality processes. It is recommended to use eight steps benchmarking process as mentioned below:

Planning:
1. Select Benchmarking subject and appropriate team
2. Identify performance indicators and Drivers
3. Select Benchmark partners
4. Determine data collection method and collect data

Analysis:
5. Analyse performance gaps.

Integration:
6. Communicate Findings and identify projects to close gaps

Action:
7. Implement plans and monitor results
8. Recalibrate benchmarks

(iii) The table is drawn as under:

Month	No. of machines employed	Working hours	Machine Hours	Production Units
July	400	225	90,000	99,000
August	500	200	1,00,000	1,00,000
September	600	250	1,50,000	1,35,000

We know, P = Productivity per machine hour,
= Number of units produced / Machine hours
For July P = 99,000/90,000 = 1.1

August P= 100,000/100,000 =1
September P = 135,000 /l 50,000 = 0.9
Interpretation: Though the total production in number of units is increasing, the productivity is declining

(d) (i) Distinguish between Run Time and Setup Time. Illustrate Throughput Time. 2+2=4

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

Total number of observations	**7000**
No. of Idle activities	**1200**
Ratio between manual to machine elements	**3 : 1**
Average rating factor	**120%**
Total number of jobs produced during study	**800 units**
Rest and personal allowances	**17%**

Compute the standard time for the job. 6

(iii) Define (a) Work Measurement and (b) Qualified Worker, as implied in work measurement. 3+3=6

Answer:

(d) (i) Run time is the time required to produce a batch of parts. This is calculated by multiplying the time required to produce each unit by the batch size. The **setup time** is the time required to prepare a machine to make a particular item. Machines that have significant setup time will typically run parts in batches.

Throughput time includes the time that the unit spends actually being worked on together with the time spent waiting in a queue. As a simple example, consider a paced assembly line that has six stations and runs with a cycle time of 30 seconds. If the stations are located one right after another and every 30 seconds parts move from one station to the next, then the throughput time is three minutes (30 seconds × 6 stations).

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

(b) Effective time per piece (T_e) = T_0 × (Production observation / Total observation)
= 9 × (5800 /7000) = 7.46 min.
The effective time is to be segregated into manual time and machine element time. Machine controlled time per piece (T_m) = 7.46 × 1/4 = 1.87 min
Hand controlled time per piece (T_h) = 7.46 × 3/4 = 5.59 min
Normal time per piece = T_m + T_h × performance rating = 1.87 + 5.59 × 1.2 = 8.58 min.
Standard time per piece = 8.58 (1 + 0.17) = 10.04 minutes.

(iii) (a) Work measurement is defined as the application of techniques designed to establish the work content of a specified task by determining the time required for carrying out the task at a defined standard of performance by a qualified worker.

(b) "A qualified worker is one who is accepted as having the necessary physical attributes, possessing the required intelligence and education and having acquired the necessary skill and knowledge to carry out the work in hand to satisfactory standards of safety, quantity and quality" - definition by International Labour Organization (ILO)

3. Answer any two questions. 16×2=32

(a) (i) State the advantages of System Development Life Cycle from the perspective of IS Audit. 3

(ii) Define Flow Chart and list major categories of flow charts. 1+3=4

(iii) State the basic purpose of Inventory Management in any business enterprise. 3

(iv) Define EIS and list the special features of an EIS. 2+4=6

Answer:

(a) (i) Advantages of System Development Life Cycle from the perspective of IS Audit:

(1) If the detailed documentation is maintained during each phase of the SDLC the IS auditor can easily understand each phases,
(2) The IS Auditor on the basis of his examination, can write in his report about the compliance by the IS management of the procedures, if any, set by the management,
(3) If the IS Auditor has a technical knowledge and ability of the area of SDLC, the IS Auditor can guide during the various phases of SDLC.
(4) The IS auditor can also provide an evaluation of the methods and techniques used through the various development phases of the SDLC.

(ii) Flowcharting is a graphic technique that can be used by analysts to represent the inputs, outputs and processes of a business in a pictorial form.

Flowcharts are divided into four major categories:

- Document flowchart - showing a document- flow through systems.
- Data flowchart - showing data flows in a system.
- System flowchart - showing controls at a physical or resource level.
- Program flowchart - showing the controls in a program in a system.

(iii) Inventory Management is a component of Materials Management and is fully integrated with the entire logistics system. The basic purpose of Inventory Management in any business enterprise is:

- Management of material stock on quantity and value basis (stock may be inputs like Raw Materials, Stores& Spares , In-Process material, Finished goods, Scraps etc.)
- Planning, Entry & Documentation of all Goods Movements
- Physical Inventory (Stock Verification)

It is directly linked with Material Requirement Planning (MRP) which may be automatic or manual, Purchasing and Invoice Verification. It is also closely linked with Production Planning, Sales & Distribution, Quality Management and Plant Maintenance.

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

According to CIMA:

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

Following are the special features of an EIS:

- It is a specially designed tool to feed executives information need.
- It is an easy - to - use and screen based software.
- It provides the executives the facilities of on-line analysis tools like time series analysis, regression analysis etc.
- It is not limited to internal data only. Access to external sources of data is also provided.
- It provides the facilities to connect to internet.
- Information is presented in summary format.
- It is a comprehensive Information System and work in conjunction with DSS.

(b) (i) Identify tangible and intangible benefits of ERP. 3+3=6
(ii) State three major misconceptions about MIS. 3

(iii) State the key functionalities of Accounts Receivable Module. 3

(iv) You are appointed as a System Analyst and assigned system analysis of the organisation. Discuss various fact finding techniques which are used for this purpose. 4

Answer:

(b) (i) Some of the quantifiable and tangible benefits of ERP system are mentioned below: Implementation of ERP, however, does not lead to headcount reduction (redundancies of few lower ended positions of payroll and accounts payable gets counterbalanced by additional higher paid IT staff).

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

In addition to tangible benefits, following intangible benefits also occur:

1. Integration of information resulting efficiency, transparency and effective MIS.
2. Error reduction, accuracy of inventory record.
3. Improved customer service, on time shipment, shorter order to shipment cycle.
4. Establishment of standardized procedures.
5. Improved accounting control and shorter sales to cash cycle.
6. Legal and regulatory compliance.

(ii) Three major misconceptions about MIS are as follows:

(1) Some people feel that the study of MIS is about the use of computers. This statement is not true.
(2) More data in reports mean more information for managers. This is a misconception. It is not the quantity of data, but, its relevance, which is important to managers in process of decision-making.
(3) It is a belief that there must be a high degree of accuracy in reporting but, this is not always true. At higher decision levels, great accuracy may not be required. Higher management is concerned with broad decisions on principles and objectives. A fairly correct presentation of relevant data often is adequate for top management decisions.

(iii) Accounts Receivable Module (AR) - This module helps in tracking all the invoices that is awaiting payment from customers. The key functionalities of AR are:

1. Accounts classification for reconciliation & control.
2. On-line credit management.
3. Reminder letters with varying degrees of severity.
4. Aging Analysis reports for review.
5. Interest for late payments.
6. Customer statements.

(iv) Various fact-finding techniques, which are used by the system analyst for determining the needs / requirements of an organization are briefly discussed below:

(a) 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.

(b) 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 fast.

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

(d) 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) (i) List the advantages and disadvantages of E-commerce. 6

(ii) Explain the Three Schema Architecture in a Database System. 6

(iii) From the following two relations of X and Y, find X - Y. 4

Relation X	
S No.	**DEP CODE**
35	**ADM**
40	**FIN**
46	**HRM**
49	**MIS**
54	**PUR**

Relation Y	
S No.	**DEP CODE**
40	**FIN**
49	**MIS**
51	**SLS**
54	**PUR**
57	**PRD**

Answer:

(c) (i) E- commerce:

Advantages:

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

Disadvantages

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

(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.

(iii) Relation X- Y

SNO	DEP CODE
35	ADM
46	HRM