INTERMEDIATE EXAMINATION

GROUP II

(SYLLABUS 2012)

SUGGESTED ANSWERS TO QUESTIONS

DECEMBER 2017

Paper- 9: OPERATION MANAGEMENT AND INFORMATION SYSTEMS

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

This paper contains 3 Sections.

All questions are compulsory,

All Section are compulsory, subject to instructions provided in each Section.

All workings must form part of your answer.

Assumptions, if any, must be clearly indicated.

SECTION – A

There are four questions in this Section, Which are compulsory,

1. Answer any five of the following questions. 2×5=10

(i) "A Good Product Design must ensure 'safety'." Please explain the 'safety' aspect with an example.

(ii) What is meant by 'Routing' in Production Planning and Control?

(iii) Explain Six Sigma Quality in a process.

(iv) 'For stocking policy analysis, the maintenance spares may be classified.' List the type of spares as per classification.

(v) How is Integration Testing of software carried out?

(vi) How is Digital Signature created?

(vii) List the important elements of a JIT manufacturing.

(viii) What are the guiding principles of 'Total Productive Maintenance'?

Answer: 1

(i) Safety: The product must be safe to "the user and should not cause any accident while using or should not cause any health hazard to the user. Safety in storage, handling and usage must be ensured by the designer and a proper package has to be provided to avoid damage during transportation and storage of the product. For example, a pharmaceutical product while used by the patient should not cause some other side effect threatening the user.

(ii) Routing: Determining the flow of work, material handling in the plant, and sequence of operations or processing steps. This is related to considerations of appropriate shop layout and plant layout, temporary storage locations for raw materials, components and semi finished goods, and of materials handling systems.

(iii) 'Sigma' (σ) is used to designate the distribution or spread about the mean (average) of any process. Sigma (0) is another word for standard deviation. For a business or manufacturing process, the Sigma value is a metric that indicates how well that process is performing. The higher the sigma value, (2σ, 3σ, 4σ etc.) the better the process. Sigma measures the capability of the process to perform defect-free-work. A defect is anything that results in customer dissatisfaction. With 6 σ, the common measurement index is 'defects-per-unit', where unit can be virtually anything-a component, a piece of a material, a line of code, an administrative form. a time frame, a distance, etc. The sigma value indicates how often defects are likely to occur. The higher the sigma value, the less likely a process will produce defects. As sigma value increases, costs go down, cycle time goes down. and customer satisfaction goes up. A six sigma process simply means that between the target specification and the tolerance limit six standard deviations can be fitted-in . Further, a six sigma process capability means 99.99966% good.

(iv) Maintenance Spares Classification:

(i) Regular Spares
(ii) Insurance Spares
(iii) Capital Spares
(iv) Rotable Spares

(v) Integration testing is an activity of software testing in which individual software modules are combined and tested as a group. This is carried out in the following manner:

- **Bottom -up Integration:** It consists of unit testing, followed by sub-system testing, and then testing of the entire system. The disadvantage is that testing of major decision / control points is deferred to a later period. In this testing it starts from the bottom-up and then it tests the entire system.
- **Top-down Integration:** Once the main module testing is complete, stubs are substituted with real modules one by one, and these modules are tested. Stubs are the incomplete portion of a program code that is put under a function in order to push the function.
- **Regression Testing:** As the software changes, each time a new module is added as part of integration testing. In the context of the integration testing, the regression tests ensure that changes or corrections have not introduced new errors.

(vi) The digital signature is created in two distinct steps. First the electronic record is converted into a message digest by using a mathematical function known as "hash function" which digitally freezes the electronic record thus ensuring the integrity of the content of the intended communication contained in the electronic record. Any tampering of the contents of the electronic record will immediately invalidate the digital signature. Secondly, the identification of the person affixing the digital signature is authenticated through the use of the private key which attaches itself to the message digest and which can be verified by anybody who has the public key corresponding to such private key This will enable anybody to verify whether the electronic record is retained intact or has been tampered with since it was so fixed with the digital signature. It will also enable a person who has a public key to identify the originator of the message.

(vii) The important elements or components of a JIT manufacturing system are:
(i) Eliminating waste
(ii) Enforced problem solving
(iii) Continuous improvement
(iv) Involvement of people
(v) Total quality management and
(vi) Parallel processing.

(viii) Guiding Principles of TPM Programs

(i) Maximise equipment effectiveness by reducing down time to zero.

(ii) Establish a thorough system of preventive maintenance for entire life span of equipment from design and acquisition to disposal.

(iii) Implement maintenance program in all organizational areas such as engineering. operation, facility management and maintenance, to spread TPM through the system.

(iv) Involve every single member of the organisation from top managers to workers on the shop floor.

(v) Assign responsibility for preventive maintenance to small, autonomous groups of employees rather than managers.

2. Match list A with List B: 1×5= 5

List A	List B
(a) Storage	**(i) To assess information requirement**
(b) Planning	**(ii) To meet demand for stock**
(c) Work Study	**(iii) To achieve the desired objectives.**
(d) System Analysis	**(iv) To standardize methods, materials and equipments involved.**
(e) Inventory Control	**(v) To arrange warehousing**

Answer: 2

List A	List B
(a) Storage	(v) To arrange warehousing
(b) Planning	(iii) To achieve the desired objectives.
(c) Work Study	(iv) To standardize methods, materials and equipments involved.
(d) System Analysis	(i) To assess information requirement
(e) Inventory Control	(ii) To meet demand for stock

3. State whether the following statement are 'Truer' or 'False': 1×5 = 5

(i) Lead time is the time between ordering goods to suppliers and delivery to customers.
(ii) Planned maintenance is also known as scheduled maintenance.
(iii) Quality Control leads to better relationship.
(iv) MIS is not concerned with changes in the environment in the business system.
(v) In ERP system, too much information creates confidence amongst users.

Answer: 3

(i) False
(ii) True
(iii) True

(iv) False
(v) False

4. Fill in the blanks by a word or two: 1×5 =5

(i) When multiple users share a database, it is likely that some users will not be authorized to _____ all information in the database.

(ii) The use of EDI eliminated many _____associated with traditional information.

(iii) The Line of Balance technique is used in _____scheduling and control.

(iv) Under ISO 9000 Standards an organisation can audit its existing system with reference to the _____to provide feedback to management.

(v) PERT and CPM force the planners to think of the various activities in the project, their time estimates, and _____.

Answer: 4

(i) Access
(ii) Problems
(iii) Production
(iv) Standard
(v) sequencing

SECTION – B

There are four questions in this Section. Answer any three questions. 15 ×3= 45

5. (a) "Many organisations have embraced strategies based on 'Quality' in order to attract and retain customers."In this context list the decision areas in strategic operations management. 7

(b) The following table gives the running costs per year and resale values of a certain equipment whose purchase price is ₹7,500. At what year is the replacement due optimally?

Year	1	2	3	4	5	6	7	8
Running Cost (₹)	1,400	1,500	1,700	2,000	2,400	2,800	3,300	3,900
Resale Value (₹)	4,500	3,500	2,700	2,200	1,800	1,500	1,500	1,500

8

Answer: 5

(a) Decision areas in strategic operations management:

1. Product and service design
2. Capacity
3. Process selection and layout
4. Work design
5. Location
6. Quality
7. Inventory
8. Maintenance
9. Scheduling

10. Supply chains
11. Projects
(Seven points are expected.)

(b)

Year	Net Capital Cost (₹) (C - S)	Running Cost (₹)	Cumulative running cost (₹)	Total cost (₹) (2) + (4)	Average annual cost (₹) (5)÷(1)
(1)	(2)	(3)	(4)	(5)	(6)
1	3,000	1.400	1,400	4,400	4,400
2	4,000	1,500	2,900	6,900	3.450
3	4,800	1,700	4,600	9,400	3,133
4	5,300	2.000	6.600	1 1,900	2,975
5	5,700	2,400	9,000	14,700	2,940
6	6,000	2,800	11,800	17.800	2,967
7	6,000	3,300	15,100	21,100	3,014
8	6,000	3,900	19,000	25,000	3,125

Optimal replacement period is at the end of 5th year.

6. (a) XYZ company has kept records of breakdowns of its machines for a 300 day work year as shown below:

No. of breakdown	Frequency in days
0	**50**
1	**130**
2	**75**
3	**25**
4	**20**
	300

The firm estimates that each breakdown costs ₹ 600 and is considering adopting a preventive maintenance program which would cost ₹225 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? 7

(b) A department of a company has to process a large number of components/month. The process equipment time required is 40 minutes/component, whereas the requirement of an imported process chemical is 1.5 litres/component. The manual skilled manpower required is 15 minutes/component for polishing and cleaning.
The following additional data is available:

	Availability/month	Efficiency of utilisation
Equipment hour	**550**	**80%**
Imported chemicals - Litres	**1100**	**90%**
Skilled manpower - hours	**275**	**75%**

(i) What is the maximum possible production under the current conditions?

(ii) If skilled man-power availability is increased by overtime by 30%, what will be the impact on production increase? 6+2=8

Answer: 6(a)

Expected number of breakdowns per year

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	50	50/300 = 0.1667	Nil
1	130	130/300 = 0.4333	0.4333
2	75	75/300 = 0.2500	0.5000
3	25	25/300 = 0.0833	0.2499
4	20	20/300 = 0.0667	0.2668
Total	300	1.0000	1.4500

Total no. of breakdowns per day = 1.45

Cost of breakdown per day =1.45 × 600 = ₹ 870

Cost of preventive maintenance programme per day = ₹ 225 + ₹ 600 = ₹ 825

Expected annual savings from the preventive maintenance programme = (870 - 825) × 300 days= 45 × 300 = ₹ 13,500.

Answer: 6(b)

(A) Actual Equipment Hrs. used = (550 × 80) / 100 = 440 Hrs. Possible output - (440 × 60) / 40 = 660 Components

(B) Imported chemicals = (1,100 × 90) /100 = 990 litres actually used; ' Possible output = 990 / 1.5 = 660 Components

(C) Skilled manpower Hrs. used- (275 × 75) / 100 = 206.25 Hrs. Possible output- (206.25 × 60) / 15 = 825 Components The bottle-neck capacity = 660 Components.

(i) Maximum possible production under the given conditions- 660 Components.

(ii) There will be no impact on production increase if skilled manpower is increased by overtime by 30% as the bottle-neck in output is equipment hours / imported chemicals.

7. (a) Explain the concept of Total Productivity. Calculate (i) Partial Productivity of Labour and (ii) Partial Productivity of Capital under the following circumstances:
A Firm uses ₹ 40,00,000 in capital and 60,000 labour hours per year to produce ₹480,00,000 in product. 3+2+2=7

(b) List the objectives of Human Resource Planning (HRP). Identify the measures for making HRP effective. 4+4=8

Answer: 7 (a)

Total Productivity is the ratio of all output to a composite of all inputs. .If it rises it signifies a rise in output relative to inputs, greater 'efficiency' in common parlance. It is called ' total' (as distinct from ' partial') productivity because it is not merely output per unit of labour alone, or any one input alone. It is the productivity of all 'factors' (i.e., inputs) taken together. Total Productivity = Total Outputs / Total Inputs

i) Partial Productivity of labour - ₹ 480,00,000 / 60.000 = ₹ 800

ii) Partial Productivity of capital- ₹ 480,00,000 / ₹ 40,00,000 = 12

Answer: 7 (b)

Objectives of HRP:

- To understand the concept and nature of human resource planning.
- To understand the process involved in human resource planning.
- To make the forecast of human resource needs and their availability in the organisation in the future.

- To understand the time dimension of human resource plans.
- To identify the barriers to effective human resource planning and
- To adopt measures to overcome these.

Measures for Making HRP Effective:

1. Commitment and involvement of top management in HRP.
2. Proactive , rather than reactive, human resource management approach.
3. Greater participation of line managers at all levels in HRP process.
4. Effective design of MR information system integrated with organisation's management information system.
5. Linking HRP to corporate strategic management process.
6. Enough flexibility in HR plans to lake care of changing situations

8. (a) List the three stages in production planning and control function with one sentence on each such stage to explain the same. Also list the production/operations management responsibilities in this regard. 3+5=8

(b) An 8 hours work measurement study in a plant reveals the following:
Units produced = 350 Nos. Idle time = 18%. Performance rating = 125%.
Allowances = 10% of normal time.
Determine the standard time per unit produced. 7

Answer: 8 (a) The 3- stages in production planning and control functions are:

1. Planning: Choosing the best course of action among several alternatives.
2. Operations: Execution as per plan
3. Control: Maintaining the performance by comparing the actual results with performance standards set and taking appropriate corrective action if necessary to reduce variance.

There are a variety of productions/operations management responsibilities such as:

(i) Product design .
(ii) Job design and process design.
(iii) Equipment selection and replacement.
(iv) Labour skills and training programs.
(v) Input material selection including raw materials and sub-contracting.
(vi) Plant location and layout.
(vii) Scheduling steps of the plan.
(viii) Implementing and controlling the schedule.
(ix) Operating the production system. The above are concerned with the design of the production process.
(x) Design control system.
(xi) Review with corrective steps/ modifications.

Answer: 8 (b)

Observed time for 350 units = Working time - Idle time = 8 - 8 × 0.18 = 8 -1.44
= 6.56 hours = 6.56 × 60 = 393.6 minutes.
Observed time per unit= 393.6 / 350 = 1.123 minutes .... (A)
Normal time per unit = (Observed time/ unit × Observed rating)/ Standard rating
= Observed time/unit × Performance rating= (1.125 × 125) / 100 = 1.40375 (B)
Standard time/unit = Normal tim¥/unit + Allowances
= 1.40375 + (10/100)× 1.40375 = 1.54413 = 1.54 minutes ..... (C)

SECTION – C

There are three questions in this Section. Answer any two questions. 15 ×2= 30

9. (a) Identify the benefits of Business Intelligence. 8

(b) With respect to DBMS, define the following in one or two sentences: 2+2=4

(i) Data Model

(ii) Database Schema

(c) From the following two relations of X and Y, find (X ∪ Y): 3

Relation X

REGN_ID	FIRST NAME
1297	SHIBANI
1300	SANTOSH
1350	TAMAL
1355	TANTINI
1360	TRIDIB
1365	TIRTHA

Relation Y

REGN_ID	NAME
1297	SHIBANI
1300	SANTOSH
1350	TAMAL
1470	SHANKAR
1480	SAROSHI

Answer: 9 (a) Benefits of Business Intelligence

(i) Time savings
(ii) Single version of truth
(iii) Improved strategies and plans
(iv) Improved tactical decisions
(v) More efficient processes
(vi) Cost savings
(vii) Faster, more accurate reporting
(viii) Improved decision making
(ix) Improved customer service
(x) Increased revenue Many benefits are intangible

Answer: 9 (b)

(i) A **data model-a** collection of concepts that can be used to describe the structure of a database-provides the necessary means to achieve this abstraction . By structure of a database we mean the data types, relationships, and constraints that should hold on the data. Most data models also include a set of **basic** operations for specifying retrievals and updates on the database.

(ii) The description of a database is called the **database schema,** which is specified during database design and is not expected to change frequently. Most data models have certain conventions for displaying the schemas as diagrams. A displayed schema is called a **schema** diagram. The diagram displays the structure of each record type but not the actual instances of records. We call each object in the schema-such as STUDENT or COURSE- a schema **construct.**

Answer: 9 (c) (X ∪ Y):

REGN ID	NAME
1297	SHIBANI

1300	SANTOSH
1350	TAMAL
1355	TATINI
1360	TRIDIB
1365	TIRTHA
1470	SHANKAR
1480	SAROSH1

10. (a) State the need for a Management Information system. What are the types of activities performed by a manager? 3+4=7

(b) State the advantages of Pre-written Application packages. 8

Answer: 10 (a)

Management Information System (MIS): Decisions are made on many issues that recur regularly and require a certain amount of information. So, the information systems can be developed so that the reports are prepared regularly to support these recurring decisions. MIS is designed to provide accurate, relevant and timely information to managers at different levels and in different functional areas throughout the organization for decision-making purpose. A manager may be required to perform following activities in an organization:

(i) Determination of organizational objectives and developing plans to achieve them.
(ii) Securing and organizing the human and physical resources so that these objectives could be accomplished.
(iii) Exercising adequate controls over the functions.
(iv) Monitoring the results to ensure that accomplishments are proceeding according to plan.

Answer: 10 (b)

Advantages of Pre-written Application Packages: The advantages of using pre-written application packages are summarized below:

(i) Rapid implementation: Just after purchasing application packages are readily available but software developed in-house may take months or even years.
(ii) Low risk: Organizations know the cost and its price as the application package is available in finished stage. With iil,-house developed software, there is an uncertainty with regard to both the quality of the final product and its final cost.
(iii) Quality: Due to high expertise of the firms engaged in application package. developments can provide better software. In contrast, in-house programmers often have to work over a wide range of application areas and they may not be possessing expertise for undertaking proposed software development.
(iv) Cost: A pie-written application package generally costs less than an in-house developed package. In addition, many hidden costs are faced by organisations that want to develop applications in-house.

11. Write short notes on: 5 × 3= 15

(a) Advantages to buyers in E-Commerce

(b) Objectives of MIS

(c) Sophisticated end users of the database

Answer: 11

(a) From the buyer's perspective also E-commerce offers a lot of advantages.

(i) Reduction in buyer' s sorting out time.
(ii) Better buyer decisions;
(iii) Less time is spent in resolving invoice and order discrepancies.
(iv) Increased opportunities for buying alternative products.

(b) Objectives of MIS.

- 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

(c) Sophisticated end users of the database.

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. There are several categories of end users i.e.. Casual end users. Naive or parametric end users, Sophisticated end users. Stand-alone users.

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.

A typical DBMS provides multiple facilities to access a database. 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.