Answer to PTP_Intermediate_Syllabus 2008_Dec2014_Set 2

Paper 9 - Operations Management & Information Systems

Time allowed-3hrs **Full Marks: 100**

Section I
(Operations Management)
Answer Question No. 1 which is compulsory and answer any two from the rest, under Section I.

Working Notes should form part of the answer.

1. (a) Fill in the blanks given below: (1 x 7 =7)

(i) ----------budgeting is a method of budgeting whereby all activities are re-evaluated each time a budget is formulated.
(ii) Progressing means directing the ---------- to proper channels and shielding them from adverse factors inseparable from actual operations.
(iii) Point rating system is one of the best known method of ----------.
(iv) ---------- provides the highest standards for quality controls of products and processes.
(v) Routine maintenance is emphasized to ensure that flows are not interrupted by ------- or malfunctioning equipment.
(vi) In solving a linear programming problem, -------- method is generally used where there are two or three variables.
(vii)---------- activities in a PERT Network do not require time or other resources.

(b) Expand the following abbreviations: (1 x 7 =7)

(i) DBR
(ii) IPPS
(iii) DS/RO
(iv) ABFS
(v) QFD
(vi) LD
(vii)CNC

Answer:

1. (a) (i) zero base
(ii) activities planned
(iii) job evaluation
(iv) Six sigma
(v) downtime
(vi) graphic
(vii) Dummy

(b) (i) Drum Buffer Rope
(ii) Integrated Production Planning System
(iii) Dynamic Slack per remaining operation
(iv) Alternative Basic Feasible Solution
(v) Quality Function Deployment

(vi) Liquidated Damages
(vii) Computerized Numerically Controlled

2. (i) A retailer deals in a perishable commodity. The daily demand and supply are variables. The data for the past 500 days show the following demand and supply:

Availability (Kg.)	Supply (No. of days)	Demand (Kg.)	Demand (No. of days)
10	40	10	50
20	50	20	110
30	190	30	200
40	150	40	100
50	70	50	40

The retailer buys the commodity at ₹ 20 per kg. and sells at ₹ 30 per kg. Any commodity remains at the end of the day, has no sales value. Moreover the loss on unsatisfied demand is ₹ 8 per Kg. Given the following pair of random numbers, simulate 6 days sales, demand and profit: (31, 18) (63, 84) (15, 79) (07, 32) (43, 75) (81, 27). The first random number in the pair is that of supply and the second random number is for demand. 9

(ii) The breakdown probability of an equipment is given below:

Month	Probability
1	0.05
2	0.15
3	0.30
4	0.30
5	0.20

There are 50 such equipments in the plant. The cost of individual preventive replacement is ₹15 per equipment and the cost of individual breakdown replacement is ₹30 per equipment. Which is the most suitable maintenance policy? Periodicities of replacement are considered every one, two, three and four months. 9

Answer:

2. (i) Probability Distribution (Supply)

Supply	Probability	Cum. Prob.	Range	Range for simulation
10	40/500 = 0.08	0.08	0 - 0.08	0 - 0.07
20	50/500 = 0.10	0.18	0.08 - 0.18	0.08 - 0.17
30	190/500 = 0.38	0.56	0.18 - 0.56	0.18 - 0.55
40	150/500 = 0.30	0.86	0.56 - 0.86	0.56 - 0.85
50	70/500 = 0.14	1.00	0.86 - 1.00	0.86 - 0.99

Probability distribution (Demand)

Demand	Probability	Cum. Prob.	Range	Range for simulation
10	50/500 = 0.10	0.10	0 - 0.10	0 - 0.09
20	110/500 = 0.22	0.32	0.10 – 0.32	0.10 – 0.31
30	200/500 = 0.40	0.72	0.32 - 0.72	0.32 – 0.71
40	100/500 = 0.20	0.92	0.72 – 0.92	0.72 – 0.91
50	40/500 = 0.08	1.00	0.92 – 1.00	0.92 – 0.99

Statement Showing Supply, Demand and Profit

Day	Supply	Demand	Sale (I)	Cost (II)	Loss on unsatisfied demand (III)	Profit/Loss I-II-III
1	30	20	600	600	-	Nil
2	40	40	1,200	800	-	400
3	20	40	600	400	160	40
4	10	30	300	200	160	-60
5	30	40	900	600	80	220
6	40	20	600	800	-	-200

(ii) Individual Breakdown Replacement Policy

The average number of individual breakdown replacements per month are:

$$\frac{\text{Number of equipments in the plant}}{\text{Average life of an equipment}}$$

Average (Mean) life of an equipment, i.e., the mean operating time before failure
= (1 x 0.05) + (2 x 0.15) + (3 x 0.30) + (4 x 0.30) + (5 x 0.20) = 3.45 months

The average number of individual breakdown replacements per month

$$\frac{\text{No. of equipments}}{\text{mean life of an equipment}} = \frac{50}{3.45} = 14.49$$

Therefore, per month cost of individual breakdown maintenance = 14.49 x ₹30 = ₹434.70

Individual Preventive Replacement Policy

Case I: Replacement period = 1 month

The total cost per unit replacement comprises two components – (a) the possibility that the equipment may fail before its replacement age, needing a breakdown replacement and (b) the possibility that the equipment may not fail till its replacement age.

Cost component (a) = (0.05) x (₹ 30)	= ₹ 1.50
Cost component (b) = (0.95) x (₹ 15)	= ₹ 14.25
Total cost of replacement per equipment	= ₹ 15.75

$$\text{Now, Cost per month} = \frac{\text{Total cost of replacement for all the equipments in the plant}}{\text{Expected life of an equipment}}$$

The expected life of an equipment, under preventive replacement period of one month is one month only, as the first breakdown coincides with the preventive replacement.

$$\text{Thus Cost per month} = \frac{(₹15.75)x(50)}{1} = ₹\ 787.50$$

Case II: Preventive Replacement Period = 2 months

Cost component (a) = (0.05 + 0.15) x (₹ 30)	= ₹ 6.00
Cost component (b) = (0.80) x (₹ 15)	= ₹ 12.00
Total cost of replacement per equipment	= ₹ 18.00

Expected life of an equipment = (1 x 0.05) + (2 x 0.95) = 1.95 months

Cost per month = $\frac{(₹18.00)x(50)}{1.95}$ = ₹ 461.54

Case III: Preventive Replacement Period = 3 months

Cost component (a) = (0.05 + 0.15 + 0.30) x (₹ 30) = ₹ 15.00
Cost component (b) = (0.50) x (₹ 15) = ₹ 7.50
Total cost of replacement per equipment = ₹ 22.50

Expected life of an equipment = (1 x 0.05) + (2 x 0.15) + (3 x 0.80) = 2.75 months

Therefore, Cost per month = $\frac{(₹22.50)x(50)}{2.75}$ = ₹ 409.09

Case IV: Preventive Replacement Period = 4 months

Cost component (a) = (0.05 + 0.15 + 0.30 + 0.30) x (₹ 30) = ₹ 24.00
Cost component (b) = (0.20) x (₹ 15) = ₹ 3.00
Total cost of replacement per equipment = ₹ 27.00

Expected life of an equipment =(1 x 0.05)+(2 x 0.15)+(3 x 0.30)+(4 x 0.50)= 3.25 months

Total cost per month = $\frac{(₹27.00)\,x\,(50)}{3.25}$ = ₹415.38

The costs (per month) of the different policies are presented in the table below:

Cost Comparisons of Different Maintenance Policies

Policy	Cost per months, ₹
Individual Breakdown Maintenance	434.70
Individual Preventive Maintenance	
I every 1 months	787.50
II every 2 months	461.54
III every 3 months	409.09
IV every 4 months	415.38

3. (i) Production Manager of a unit wants to know from what quantity he can use automatic machine against semi-automatic machine.

Data	Automatic	Semi-automatic
Time for the job	**4 mins**	**10 mins**
Set up time	**4 hrs**	**3 hrs**
Cost per hour	**₹40**	**₹24**

Calculate the break-even point. **7**

(ii) The demand for three months for 100 Watt bulbs is given below:

Period	January	February	March
Demand	**1000**	**1200**	**1600**

If the weight assigned to the period of January, February and March are 0.25, 0.35 and 0.4 respectively, forecast the demand for the month of April by using Weighted Moving Average Method. 4

(iii) A project with normal duration and cost along with crash duration and cost for each activity is given below:

Activity	Normal time (Hrs.)	Norman cost (₹)	Crash time (Hrs.)	Crash cost (₹)
1-2	5	200	4	300
2-3	5	30	5	30
2-4	9	320	7	480
2-5	12	620	10	710
3-5	6	150	5	200
4-5	0	0	0	0
5-6	8	220	6	310
6-7	6	300	5	370

Overhead cost is ₹ 50 per hour.
Required:
(1) Draw network diagram and identify the critical path. 7

Answer:

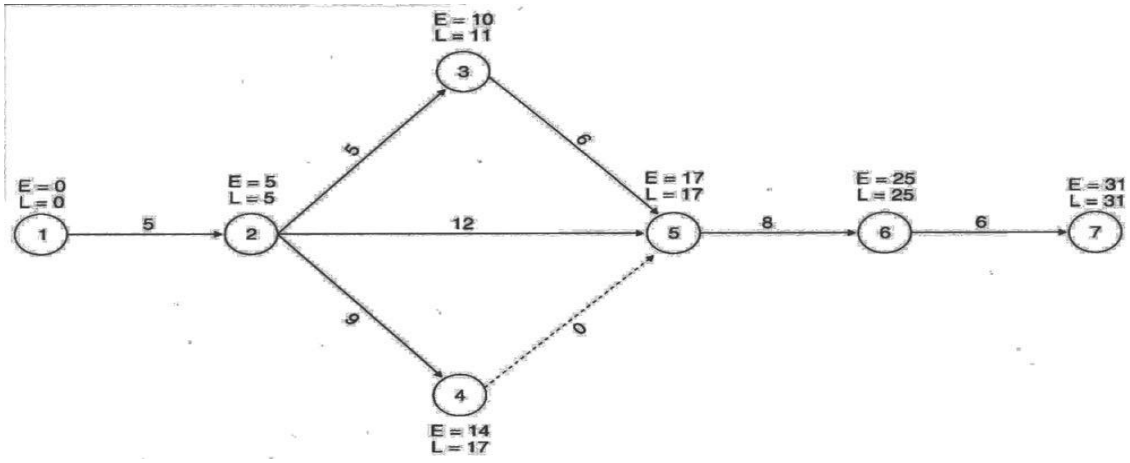
3. (i) Let x be the break-even quantity between automatic and semi-automatic machines. This means, for volume of output x, the total cost of manufacture is the same on both automatic and semi-automatic machines.
For quantity =x units
Total manufacturing cost on automatic machines= (4.0 + 4x/60) x 40
Total manufacturing cost on semi-automatic machines = (3.0 +10x/60) x 24
If 'x' is the break-even quantity, then
(4.0 + 4x/60) x 40 = (3.0 +10x/60) x 24
160 + (4x/60) x 40 = 72 + (10x/60) x 24
160 + 8x/3 = 72 + 4x
4x -8x/3= 160 -72
4x/3 = 88
x= 66 units.
Hence for quantity upto 65, a semi-automatic machine will be cheaper. For quantity 66, both semi-automatic and automatic machines are equally costly. For quantity more than 66, automatic machine becomes cheaper than semi-automatic machine.

(ii) D_1 =1000 nos. W_1 = 0.25
D_2 = 1200 nos. W_2 = 0.35
D_3 = 1600 nos. W_3 = 0.40

Therefore Weighted Moving Average = $W_1 \times D_1 + W_2 \times D_2 + W_3 \times D_3$
= 0.25 x 1000 + 0.35 x 1200 + 0.40 x 1600
= 250 + 420 + 640
= 1310.

The demand for the month of April is 1310 nos. of 100 Watt bulbs.

(iii)



Paths →	1-2-5-6-7 (Let's denote this by A)	1-2-3-5-6-7 (Let's denote this by B)	1-2-4-5-6-7 (Let's denote this by C)
Duration	31 hours	30 hours	28 hours
The critical path is A. Its duration is 31 hours			

4. (i) Describe Zero Date of a project. 5
(ii) Define Competitive Benchmarking. 3
(iii) What is the utility of a Single purpose machine tool? 3
(iv) State the activities included in JIT manufacturing. 7

Answer:

4. (i) The last step in establishing a project is the fixation of Zero Date. The Zero Date of a project is the date when the project effectively starts. The project time starts from this date. This date is the beginning date for the project and the project completion period will be counted from this date and therefore, anything that affects the performance of the project will have to be defined or established or started by this project. This applies not only to time, cost and technical parameters of the project, but also to infrastructural facilities, formation of a new company or division, governmental clearances and other activities needed for putting up the project. The activities that must be completed before the Zero Date are known as pre-project activities. Once the pre-project activities take a definite shape the Zero date is exactly defined.

(ii) "A measure of organizational performance compared against competing organization, studies the target specific product designs, process capabilities or administrative methods used by a company's direct competitors".
Competitive Benchmarking moved beyond product oriented comparisons to include comparisons of process with those of competitors. In this benchmarking, the process studied may include marketing, finance, human resource, R&D etc.

(iii) A single purpose machine is one that is capable of doing only particular kind of operation, but is not restricted to one particular job. As for example, a Shell Turning Lathe is designed especially for shell turning and is not adopted for general lathe work. A hobbing machine, a honing machine etc. are other examples of single-purpose machines.

(iv) JIT manufacturing includes many activities:

- **Inventory reduction:** JIT is a system for reducing inventory levels at all stages of production viz. raw materials, work-in-progress and finished goods.
- **Quality improvement:** JIT provides a procedure for improving quality both within the firm and outside the firm.
- **Lead time reduction:** With JIT, lead time components such as set-up and move times are significantly reduced.
- **Vendor control/Performance improvement:** JIT gives the buying organisation greater power in buyer supplier relationship. The firm moves from a situation where multiple suppliers are used to a situation where only one or two suppliers are used for supplying most parts. With fewer suppliers; the buying organisation has more power because it is making larger purchases from each vendor. Also, the buying organisation can now impose higher requirements on each supplier in terms of delivery and quality.
- **Continuous Improvement:** In the JIT system, existing problems are corrected and new problems identified in a never-ending approach to operations management.
- **Total Preventive Maintenance:** JIT emphasises preventive maintenance to reduce the risk of equipment break-downs which may cause production hold ups and increase in manufacturing cycle time due to delays.
- **Strategic Gain:** JIT provides the firm's management with a means of developing, implementing and maintaining a sustainable competitive advantage in the market place.

Section II
Information System

Answer Question No. 5 which is compulsory and answer any two from the rest, under Section II.

5. (a) Fill in the blanks given below : (1 x 10 =10)

(i) ---------- is the structured transmission of data between organizations by electronic means.

(ii) ---------- covers a large geographic area with various communication facilities such as long distance telephone services, satellite transmission and under-sea cables.

(iii) ---------- system is an integrated computer based application used to manage internal and external resources, including tangible assets, financial resources, material and human resources.

(iv) In a ---------- phase, the software is usually run in parallel with the current system for sometime.

(v) A ---------- with a value of 0 or 1 is added to a block of data for error detection purposes.

(vi) ---------- audit is the process of examining and evaluating of adequacy and effectiveness of internal controls.

(vii) Redundancy is the ---------- of identical data in the storage.

(viii) A query language is a set of ---------- for creating, updating and accessing data from database.

(ix) An ---------- system is an advanced model of Decision Support System which can take care of unstructured problem situation.

(x) Encryption is a process of converting a text into a ---------- form by the use of some mathematical function.

(b) Expand the following abbreviations: (1 x 4 =4)

(i) RISC
(ii) ORDBMS
(iii) MODEM
(iv) EEPROM

Answer:

5. (a) (i) Electronic Data Interchange
(ii) Wide Area Network
(iii) enterprise resource planning
(iv) going live
(v) parity bit
(vi) Information system
(vii) duplication
(viii) commands
(ix) Executive Information
(x) scrambled

(b) (i) Reduced instruction set computing
(ii) Object relational database management system
(iii) Modulator demodulator
(iv) Electrically erasable programmable read only memory

6. (i) Discuss the functions of a web browser. 4
(ii) List the factors for high popularity of internet. 6
(iii) What are the strengths/Advantages of Prototyping Model. 6
(iv) State the critical factors involved in data warehousing. 2

Answer:

6. (i) Web Browser is a software which helps the user to contact a web server. Functions of a web browser are:

- Receiving the requests from the user
- Sending the request the web server for information
- Receives the information from the web server
- Sending it the user

The browser is the interface between the user and the web server. Browser allows the user to have access to both text as well as graphical picture. Browsing graphical picture is time consuming.

(ii) Factors for high popularity of internet :

- Instant communication facilities has resulted phenomenal growth in business efficiency
- Phenomenal reduction in communication cost
- The cost of hardware and technology is within the reach of small entrepreneurs
- Display of information about an organization, its activity and product through websites has become a common mode of advertisement
- Accelerating dissemination of knowledge and information
- Prospect of E-commerce

- The commercial success of Business Process Outsourcing
- A facilitating media for recruitment etc.

(iii) Strengths/Advantages of Prototyping Model are:

(i) It provides quick implementation of an incomplete, but functional, application.
(ii) Prototyping requires intensive involvement by the system users.
(iii) A very short time period is normally required to develop and start experimenting with a prototype.
(iv) Since system users experiment with each version of the prototype through an interactive process, errors are hopefully detected and eliminated early in the developmental process.
(v) It reduces the cost of user training.
(vi) It improves the fact finding process.
(vii) It helps to identify confusing or difficult functions and missing functionality.
(viii) Prototyping model encourages innovation and flexible designs.

(iv) Critical factors involved in data warehousing:

- Heterogeneous data set and their translation in common format
- Organization of database
- Capability of software tool
- Judgement on transactional period for storage of data

7. (i) Describe Non-programmed decision making. 4
(ii) Describe Integrative Approach. 4
(iii) Discuss the sources and benefits of knowledge management. 5
(iv) List the advantages of e-mail. 5

Answer:

7. (i) Non-programmed decision making refers to those decision making process which does not go by any predetermined set of guidelines. Normally this type of decision making takes place to handle special business situations with the help of experience, judgement and vision of the decision maker. In case of nonprogrammed decision making, information are unstructured and external environmental information is a must along with internal information sets. For example, for decision on business policy many non-standard information like technology change, competitors market share etc is required apart from internal information of sales of different products.

(ii) This approach in a more scientific approach for easy integration of sub-systems and takes care of the limitations in the other two approaches described above by way of better planning. Under this system, the top management identifies the information requirements from different sub-systems and specifies other guidelines for integration of these information for effective support to decision making. The managers from different functional areas present the flow of information under individual sub-systems. The aspect of integration of information of different sub-systems is considered at the planning stage. Any modifications required at different points are pre-conceived at the beginning so that they are taken care from the design stage. This approach of implementation allows designing better structure of databases and ensures smooth flow of information at different levels of management of different functional areas.

(iii) Knowledge base stands in one place on the organization in a structured manner so that it is accessible by the users in the organization. The aim of knowledge management is to guide the managers in taking appropriate decisions, prevent managers to do the same mistakes and forecast on business outcome and showing the path of success.
Sources of Knowledge.
- Information base
- Past experience
- Expertise in specialized field
- Sophisticated analytical ability with mathematical tools

Benefit of Knowledge Management:
- Increased ability to compete
- Richer knowledge stock
- Effective utilization of resources
- Stronger 'base of ideas' for innovation

(iv) Advantages of e-mail – mail has become very effective mode of communications in business environment or at personal level. The advantages are many which can be summarized as below:
1. **Speed –** The communication through electronic media is instantaneous from one corner of the globe to the other.
2. **Cost –** Cost is very low compared to any other mode of communication.
3. **Sharing information** – Same message can be sent to multiple receivers at one go giving all e-mail addresses of individual receivers.
4. **Documentation of communication –** An e-mail keeps date and time which is preserved with the message. This is useful for the purpose of auditing the communication in case of future complicacy.
5. **Powerful media for communication –** The multimedia combining text, graphics etc. can be sent as attached files.

8. (i) Write a note on Disaster Recovery Plan. 6
(ii) What provisions are developed to take care of eventuality in case of failure? 6
(iii) List the different phases of ERP implementation project. 6

Answer:

8. (i) The damage under disaster is generally enormous. The question of recovery in case of disaster comes from data. Data may be categorized as critical, vital, sensitive and non-critical. Recover plan may be devised accordingly to given priority of recovery of data of different importance.
Emergency Action : In the first stage the notification of damage is to be given to the appropriate agency/authority like fire service, police, insurance company etc. Then following action may be taken depending on the situation to save personnel, equipment, data etc like:
- sounding alarm bell
- use of fire extinguisher
- saving the back-up of software, data etc.

Recovery Action: There needs an advanced planning for recovery of data under disaster. Generally, the disaster recovery planning is done by a Recovery Committee and execution of recovery programmes is done under its supervision and control. These are:
- Backup Application software and backup of databases at a regular interval to be preserved in some other location.

- Mirror imaging of disk.
- Selection of alternative computer system.
- Restoration of application software and databases in the new computer system.
- Critical evaluation of performance of the application software.
- Assessment of loss of databases.
- Plan for recovery of data loss etc.

(ii) Following provisions and environment are developed to check the occurrence of risk factors or to take care the eventuality in case of failure:

i) **Documentation:** Documentation on Policy, procedure and System Administration.
ii) **Creation of congenial Environment:** Care Environment free from hazards to minimize chance of damage of systems.
iii) **Preventive Maintenance:** Regular and timely preventive maintenance.
iv) **Quality Management:** Ensuring the quality of software at the development, testing and operational efficiency etc.
v) **Security Management:** Strict control on unauthorized access by password and different types of permissions to allow access to / operation of the system to different sets of operating staff.
vi) **Recovery System:** Regular back-up of data files to take care of damage or failure and parallel processing for real-time system.
vii) **System Administration:** Follow of strict code of system administration.
viii) **Set of Routine Procedure:** Keeping regular vigilance on probable damage options.
ix) **Training:** Training to improve the awareness of control among the employees.
x) **Ethical Standard:** Special care for maintenance ethical standard in the working environment etc.

(iii) ERP implementation project involves different phases which have definite activities as explained below:

1. **Pre-evaluation screening –** to search for perfect package which will be most suitable in terms of functional fit of the business process, skill set available and easiness to adopt.
2. **Package evaluation –** to understanding the performance of the business and do the cost benefit analysis.
3. **Project Planning Phase –** to make a tentative plan for implementation in terms of time, identification of person responsible for co-ordination of the implementation programmes, skill development and monitoring the progress.
4. **Gap Analysis –** to identify the gap between the existing system and future expectations from the ERP system so as to optimize the outcome from the implementation programme.
5. **Re-engineering –** to bring the necessary changes in the system in terms of physical system, hardware, mindset of the people, data flow and reporting.
6. **Configuration –** to install the necessary hardware, data base management system and configuration of the ERP system accordingly.
7. **Testing –** to test the system with test data set like entering data, validating them and generating reports for all modules and checking their correctness.
8. **End user Training –** to impart training to people from different functional areas who will be associated with operations and handling reports.
9. **Going live –** to finally switching over to new system with data migration, and running the system with live data of all functional areas.
10. **Post – Implementation** – to arrange for maintenance of the system in terms provision of technical expertise in cases of problems.