

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

Paper 9 - Operations Management & Information Systems

Time allowed-3hrs

Full Marks: 100

Section I: Operation Management

Answer Question No. 1 which is compulsory and any
Two questions from the rest, under Section I.

Working Notes should form part of the answer.

1. (a) Choose the most appropriate alternative: [8]
- (i) Deming Prize is one of the highest awards in the world associated with
 - (A) TQM
 - (B) TPM
 - (C) Quality Circle
 - (D) Workplace improvement.
 - (ii) Industrial Engineering is a
 - (A) Line Function
 - (B) Staff Function
 - (C) Both line and staff function
 - (D) Co-ordination function
 - (iii) PERT is:
 - (A) Activity oriented technique
 - (B) Event oriented technique
 - (C) Both (A) and (B)
 - (D) None of these
 - (iv) Most suitable layout for job production is:
 - (A) Line layout
 - (B) Matrix layout
 - (C) Process layout
 - (D) Product layout
 - (v) The card which shows the number of rejected products from total quantity produced is:
 - (A) Quality Control Card
 - (B) Inspection Card
 - (C) Rejection Card
 - (D) Job Card
 - (vi) In Job production system, we need:
 - (A) Unskilled labours
 - (B) Semi-skilled labours
 - (C) Skilled labours
 - (D) Both (B) and (C)
 - (vii) The starting point of production cycle is:
 - (A) Production Planning
 - (B) Product design
 - (C) Routing
 - (D) Market research
 - (viii) 'Z' chart is a chart used in:
 - (A) Programme Control
 - (B) Job Control
 - (C) Cost Control
 - (D) Quality Control

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

- (b) Fill in the blanks given below : [6]
- (i) Manpower efficiency of an unit is measured by -----.
- (ii) In formulating the linear programming problem, the basic step is to set up some ----- model.
- (iii) Zero Date of a project means the effective ----- date of the project.
- (iv) Detailed project report is prepared after the -----.
- (v) Risk prone is the opposite of -----.
- (vi) ----- layout is used for mass production.

Answer:

1. (a) (i) (A) TQM
 (ii) (B) Staff Function
 (iii) (B) Event oriented technique
 (iv) (C) Process layout
 (v) (B) Inspection Card
 (vi) (C) Skilled labours
 (vii) (D) Market research
 (viii) (A) Programme Control

- (b) (i) labour productivity index
 (ii) Mathematical
 (iii) starting
 (iv) Feasibility Report
 (v) risk averse
 (vi) product

2. (a) The Secretary of a school is taking bids on city's four school bus routes. Four companies have made the bids as detailed in the following table:

	Bids			
	Route 1	Route 2	Route 3	Route 4
Company 1	₹4000	₹5000		
Company 2		₹4000		₹4000
Company 3	₹3000		₹2000	
Company 4			₹4000	₹5000

Suppose each bidder can be assigned only one route. Use the assignment model to minimize the school's cost of running the four bus routes. [10]

- (b) The data on the operating costs per year and resale prices of equipment A whose purchase price is ₹10,000 are given below:

Year	1	2	3	4	5	6	7
Operating Cost (₹)	1500	1900	2300	2900	3600	4500	5500
Resale Value (₹)	5000	2500	1250	600	400	400	400

- (i) What is the optimum period for replacement?
- (ii) When equipment A is 2 years old, equipment B, which is a new model for the same usage, is available. The optimum period for replacement is 4 years with an average cost of ₹3600. Should you change equipment A with that of B? If so, when? [5+3]

Answer:

2. (a)

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

	Bids			
	Route 1	Route 2	Route 3	Route 4
Company 1	₹4000	₹5000	M	M
Company 2	M	₹4000	M	₹4000
Company 3	₹3000	M	₹2000	M
Company 4	M	M	₹4000	₹5000

Row reduction

	Route 1	Route 2	Route 3	Route 4
Company 1	0	1000	M - 4000	M - 4000
Company 2	M - 4000	0	M - 4000	0
Company 3	1000	M - 2000	0	M - 2000
Company 4	M - 4000	M - 4000	0	1000

Column reduction is not required as there is zero in each column.

Minimum lines to cut zeros

	Route 1	Route 2	Route 3	Route 4
Company 1	0	1000	M - 4000	M - 4000
Company 2	M - 4000	0	M - 4000	0
Company 3	1000	M - 2000	0	M - 2000
Company 4	M - 4000	M - 4000	0	1000

As the minimum number of lines are not equal to order of matrix, let's take step to increase the number of zeros.

	Route 1	Route 2	Route 3	Route 4
Company 1	0	1000	M - 3000	M - 4000
Company 2	M - 4000	0	M - 3000	0
Company 3	0	M - 3000	0	M - 3000
Company 4	M - 5000	M - 5000	0	0

Minimum lines to cut zeros

	Route 1	Route 2	Route 3	Route 4
Company 1	0	1000	M - 3000	M - 4000
Company 2	M - 4000	0	M - 3000	0
Company 3	0	M - 3000	0	M - 3000
Company 4	M - 5000	M - 5000	0	0

As the minimum number of lines are equal to order of matrix, optimal assignment should be made

Optimal Assignment

	Route 1	Route 2	Route 3	Route 4
Company 1	0	1000	M - 3000	M - 4000
Company 2	M - 4000	0	M - 3000	0
Company 3	0	M - 3000	0	M - 3000
Company 4	M - 5000	M - 5000	0	0

Company	1	2	3	4	
Route	1	2	3	4	
Cost	4000	4000	2000	5000	

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

- (b) (i) The determination of the optimal period of replacement of equipment A is given in Table below:

Table: Determination of Optimal Replacement Period

Year	Operating Cost (A)	Cum. Operating Cost (B)	Purchase Price – Resale Value (C)	T(n) (B+C)=D	A(n) (D / Years)
1	1500	1500	5000	6500	6500.0
2	1900	3400	7500	10900	5450.0
3	2300	5700	8750	14450	4816.7
4	2900	8600	9400	18000	4500.0
5	3600	12200	9600	21800	4360.0*
6	4500	16700	9600	26300	4383.3
7	5500	22200	9600	31800	4542.9

Since the average cost corresponding to the 5-yearly period is the least, the optimal period for replacement = 5 years.

- (ii) As the minimum average cost for equipment B is smaller than that for equipment A, 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 ₹3,600 (the average cost for equipment B). The equipment A shall be held as long as the marginal cost of holding it would be smaller than the minimum average cost for equipment B. The calculations are given here:

Year	Operating Cost	Depreciation	Total Cost
3	2300	1250(=2500-1250)	3550
4	2900	650 (=1250-600)	3550
5	3600	200(=600-400)	3800

Since the cost incurred in keeping the equipment A in the third and the fourth years is less than the average cost for equipment B, the replacement should be done after 2 years.

3. (a) A shaft 2400 mm in length is being machined on a lathe. If the spindle rotates 1200 r.p.m. and the feed is 0.50 mm per revolution, how long will it take the cutter to pass down the entire length of the shaft? [3]
- (b) DTM Bearings Ltd. is committed to supply 48,000 bearings per annum to AD Machines on a steady daily basis. It is estimated that it costs ₹1.00 as inventory holding cost per bearing per month and that the setup cost per run of bearing manufacture is ₹6,480.
- (i) What is the optimum run size for bearing manufacture?
- (ii) What should be the interval between the consecutive optimum runs?
- (iii) What is the minimum inventory holding cost? [2+1+2]
- (c) Write a short note on Value Engineering. [4]
- (d) A new project has been set up by A Ltd. The company plans to achieve 80% capacity in the third year of operation, when the expected sales will be 32,000 units and the selling price ₹30.00 per unit. The corresponding variable costs and fixed costs are estimated at ₹5,76,000 and ₹3,00,000 respectively.
- Calculate the following from the data given:
- (i) P/V Ratio
- (ii) Break-Even Point in terms of % Capacity
- (iii) Margin of Safety. [2+2+2]

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

Answer:

3. (a) Since the feed is 0.50 mm per revolution.
 The number of revolutions in passing 2400 mm = $2400/0.50$ revolutions
 = 4800 revolutions.
 Since the spindle executes 1200 rpm, the time required = $4800/1200 = 4$ minutes.

- (b) (i) Optimum run-size or Economic Batch Quantity (EBQ)

$$= \sqrt{\frac{2 \times \text{Annual Output} \times \text{Setup cost}}{\text{Annual cost of carrying one unit}}}$$

$$= \sqrt{\frac{2 \times 48000 \times 6480}{1 \times 12}} = 7200 \text{ units}$$

- (ii) Interval between two consecutive optimum runs

$$= \frac{\text{EBQ}}{\text{Monthly output}} \times 30$$

$$= \frac{7200}{48000 \div 12} \times 30 = 54 \text{ calendar days}$$

- (iii) Minimum Inventory holding cost

$$= \text{Average inventory} \times \text{Annual carrying cost of one unit of inventory}$$

$$= \frac{7200}{2} \times 1 \times 12$$

$$= ₹43,200$$

- (c) Value engineering or value analysis is concerned with the improvement of design and specifications at various stages such as research, development, design and product development. Benefits of value engineering are:

- (i) Cost reduction.
- (ii) Less complex products.
- (iii) Use of standard parts / components.
- (iv) Improvement in functions of the product.
- (v) Better job design and job safety.
- (vi) Better maintainability and serviceability.
- (vii) Robust design.

Value engineering aims at cost reduction at equivalent performance. It can reduce costs to the extent of 15% to 70% without reducing quality. While value engineering focuses on preproduction design improvement, value analysis, a related technique seeks improvements during the production process.

- (d)

Particulars	₹
Sales realization (32000 units @ ₹ 30/-)	9,60,000
Less: Variable Costs	5,76,000
Contribution	3,84,000
Less: Fixed Costs	3,00,000
Net Profit	84,000

$$\text{Ratio of Fixed Costs to Contribution} = 3,00,000 / 3,84,000$$

$$= 0.78125$$

- (i) P/V Ratio = $(\text{Contribution} / \text{Sales}) \times 100\%$

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

$$= (384,000 / 9,60,000) \times 100\% = 40\%$$

- (ii) Break-Even Point in terms of % Capacity
 $= (\text{Fixed Costs} / \text{contribution}) \times (\text{Capacity Achieved})$
 $= 0.78125 \times 80\% = 62.5\%$
- (iii) Margin of Safety = (Net Profit) / (P/V Ratio)
 $= 84,000 / (0.4) = ₹2,10,000$

4. (a) An industrial engineer deputed to conduct a time study for job, has after observation, divided the job into 5 elements. He had noted the timings for four cycles of the job as below:

Element	Time in minutes				Performance rating (%)
	Cycle 1	Cycle 2	Cycle 3	Cycle 4	
1	1.246	1.328	1.298	1.306	90%
2	0.972	0.895	0.798	0.919	100%
3	0.914	1.875	1.964	1.972	100%
4	2.121	2.198	2.146	2.421	110%
5	1.253	1.175	1.413	2.218	100%

- (i) Are there any outliers in the data i.e. probable errors in reading or recording data which should not be included in the analysis?
- (ii) Compute the basic time for the job and the standard time if a relaxation allowance of 12%, a contingency allowance of 3% and an incentive of 20% are applicable for the job. [1+5]
- (b) The output of production line is checked by an inspector for one or more of three different types of defects A, B, and C. If defect A occurs, the item is scrapped. If defect B or C occurs, the item must be reworked. The time required to rework a B defect is 15 minutes and the time required to rework a C defect is 30 minutes. The probabilities of an A, B and C defects are 0.15, 0.20 and 0.10 respectively. For ten items coming off the assembly line, determine the number of items without any defects, the number scrapped and total minutes of rework time. Use the following random numbers:

RN for defects A:

48	55	91	40	93	01	83	63	47	52
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RN for defects B:

47	36	57	04	79	55	10	13	57	09
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RN for defects C:

82	95	18	96	20	84	56	11	52	03
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[3+3+3]

- (c) What are the advantages of preventive maintenance?

[3]

Answer:

4. (a) (i) The times for element No. 3 in cycle 1 and for element No. 5 in cycle 4 are suspected and should be disregarded as they vary very much as compared with time values for these elements in other cycles.
- (iii) The basic time or normal time is calculated on the basis of data excluding the outliers as below:

Element	Mean actual time (Minutes)	Performance rating (%)	Normal or basic time (minutes)

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

1	1.295 $= \frac{1.246 + 1.328 + 1.298 + 1.306}{4}$	90	$\frac{1.295 \times 90}{100} = 1.166$
2	0.896 $= \frac{0.972 + 0.895 + 0.798 + 0.919}{4}$	100	$\frac{0.896 \times 100}{100} = 0.896$
3	1.937 $= \frac{1.875 + 1.964 + 1.972}{3}$	100	$\frac{1.937 \times 100}{100} = 1.937$
4	2.222 $= \frac{2.121 + 2.198 + 2.146 + 2.421}{4}$	110	$\frac{2.222 \times 110}{100} = 2.444$
5	1.280 $= \frac{1.253 + 1.175 + 1.413}{3}$	100	$\frac{1.280 \times 100}{100} = 1.280$

Normal time for the total job which include all five elements = 7.723 minutes

Calculation of standard time

Standard time for the job = Normal time + Allowances

$$= 7.723 + \frac{12}{100} \times 7.723 + \frac{3}{100} \times 7.723$$

$$= 7.723 + 0.927 + 0.231 = 8.881 \text{ minutes}$$

If 20% incentive allowance is given, total time allowed under incentive scheme

$$= 8.881 + \frac{20}{100} \times 8.881$$

$$= 8.881 + 1.776 = 10.657 \text{ minutes}$$

(b) Probability distribution (Defect A)

Event	Prob.	Cum. Prob.	Probability range	Probability range for simulation
Defect	0.15	0.15	0-0.15	0-0.14
No defect	0.85	1.00	0.15-1.00	0.15-0.99

Probability distribution (Defect B)

Event	Prob.	Cum. Prob.	Probability range	Probability range for simulation
Defect	0.20	0.20	0-0.20	0-0.19
No defect	0.80	1.00	0.20-1.00	0.20-0.99

Probability distribution (Defect C)

Event	Prob.	Cum. Prob.	Probability range	Probability range for simulation
Defect	0.10	0.10	0-0.10	0-0.09
No defect	0.90	1.00	0.10-1.00	0.10-0.99

Item	Defect A	Defect B	Defect C	Rework time
1	No	No	No	
2	No	No	No	
3	No	No	No	
4	No	Yes	No	15m
5	No	No	No	

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

6	Yes	No	No	
7	No	Yes	No	15m
8	No	Yes	No	15m
9	No	No	No	
10	No	Yes	Yes	15m + 30m
			90m	

No. of defect items : 5	Scrap : 1 (Item No. 6)	Rework : 4
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- (c) Advantages of preventive maintenance are:
- (i) Reduced breakdowns and downtime.
 - (ii) Greater safety to workers.
 - (iii) Fewer large scale repairs.
 - (iv) Less standby or reserve equipment or spares.
 - (v) Lower unit cost of the product manufactured.
 - (vi) Better product quality.
 - (vii) Increased equipments life, and
 - (viii) Better industrial relations.

Section II: Information Systems

Answer Question No. 5 which is compulsory and Any two questions from the rest.

5. (a) Fill in the blanks given below : [5]
- (i) ----- is a provision of secondary storage which acts as primary memory.
 - (ii) A newer version of ASCII is the -----.
 - (iii) ----- generally refers to an intelligent terminal in a networking environment.
 - (iv) ----- is an object relational database management system.
 - (v) ----- contains the information which are of permanent in nature.
- (b) Discuss briefly the following term with reference to Information Technology: [5]
- (i) DDL Compiler
 - (ii) Buffering
 - (iii) Index Field
 - (iv) Meta Data
 - (v) Transaction Log
- (c) State whether following statements are True or False: [4]
- (i) In LAN each computer can fulfill a function.
 - (ii) CD-ROMs are produced on a mass scale.
 - (iii) Only executable files can be infected by virus
 - (iv) Processing is done in the primary storage unit.

Answer:

5. (a) (i) Virtual Memory
(ii) ASCII – 8
(iii) Workstation
(iv) Oracle
(v) Master File
- (b) (i) DDL Compiler converts data definition statements into a set of tables.

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

- (ii) Buffering enables the processor to execute another instruction while input or output is taking place rather than being idle while transfer was completed.
- (iii) Index fields are used to store relevant information along with documents. The data input to an index field is used to find those documents when needed.
- (iv) Meta data or "data about data" is used to inform operators and users of the data warehouse about its status and the information held within the data warehouse.
- (v) A transaction log is a file that records database modifications such as insert, update, delete, commit, rollback and database schema changes.

- (c) (i) True
- (ii) True
- (iii) False
- (iv) False

6. (a) What are the advantages of CBIS? [6]
(b) Define closed system. [4]
(c) Discuss the various reporting tools available in Data Warehouse. [4]
(d) Explain the different types of Database backups. [4]

Answer:

6. (a) The advantages of CBIS are:
- Reduction in cost of record maintenance
 - Improvement in the efficiency of human resources
 - Regular flow of information at different levels of management
 - Easy use of scientific tools and models for quality decision making
 - Faster response to customers
 - Better control over resources
 - Faster access to records in case of dispute
 - Effective use of manpower etc.
- (b) A closed system which does not have any interaction with outside environment. In other words, it functions in the closed environment set and is insular with the change in the environment. A closed system is a self contained one and normally a rigid one. As business environment is subject to change and a business system is expected to adjust itself with the change in the environmental factors. In other words, a business system cannot be closed system. In fact, close systems are very limited. Some systems in Military or Defense Service may be closed system because their rules, procedure and factors are set to be rigid for the sake of strict code of discipline.
- (c) Various reporting tools available in Data Warehouse are discussed below.
- (i) **Business Intelligence tools:** These are software applications that simplify the process of development and production of business reports based on warehousing data.
 - (ii) **Executive Information System tools:** These are software applications that are used to display complex business metrics and information in a graphical way to allow rapid understanding of the overall process.
 - (iii) **Online Analytical Processing (OLAP) tools:** They form data into logical multi-dimensional structures and allow users to select dimensions to view data.
 - (iv) **Data Mining tools:** They are software that allows users to perform detailed mathematical and statistical calculations on detailed warehousing data to detect trends, identify patterns and analyze data.

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

(d) Different types of database backups are given as follows:

- **On-line backup:** It is performed by executing the command-line or from the "Backup database" utility. When an on-line backup process begins, the database engine externalizes all cached data pages kept in memory to the database file on disk. This process is called a check point. The database engine continues recording activity in the transaction log file while the database is being backed up. The log file is backed up after the backup utility finishes backing up the database. The log file contains all of the transactions recorded since the last database backup. For this reason the log file from an on-line full backup must be applied to the database during recovery.
- **Live backup:** A live backup is carried out by using the BACKUP utility with the command-line option. A live backup provides a redundant copy of the transaction log for restart of the system on a secondary machine in the event the primary database server machine becomes unusable.
- **Full database backup:** For a full backup, the database backup utility copies the database and log. A full backup captures all files on the disk or within the folder selected for backup. With a full backup system, every backup generation contains every file in the backup set.
- **Incremental Backup:** An incremental backup uses the DBBACKUP utility to copy the transaction log file since the most recent full backup. When we perform an incremental backup, the mirror log is not backed up. When we backup and renamed the log files, the transaction and mirror logs file are renamed and a new log files are created. One must plan to manually backup the mirror log.

7. (a) What is Integration testing? How is it carried out? [3]
(b) Define the Master Data Management of an ERP System. [3]
(c) Write a short note on tailor made software. [3]
(d) What is non-programmed decision making? [4]
(e) What is Virus Scanning? What are its negative effects? [5]

Answer:

7. (a) **Integration Testing**

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, the software changes. In the context of the integration testing, the regression tests ensure that changes or corrections have not introduced new errors.

(b) **Master Data Management of an ERP System:**

ERP packages contain several modules, such as finance, sales and distribution, materials management, manufacturing and production control, human resources, plant maintenance and quality management. Main characteristics of ERP system is that all its modules function in an integrated manner. Due to integrated nature of functioning, a

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

few master tables are referenced frequently all across the system and databases, and shared by different applications, functional areas and sites. Data incorporated thereon need to be accurate, complete, timely and consistent. The quality of data as inputted in master tables, is a major reason for success or otherwise of an ERP system.

- (c) Tailor made software means software developed according to the need of a particular organization. This can be done after following the total system development cycle for a system. The advantages are taking care of full requirement of the system with provision of change in future to accommodate new developments. The disadvantages are the long implementation time due to full software development cycle followed and the higher cost involvement.
- (d) Non-programmed decision making refers to those decision making process which does not go by any pre-determined set of guidelines. Normally this type of decision making takes place to handle special business situations with the help of experience, judgment and vision of the decision maker. In case of non-programmed decision making, informations 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.
- (e) Virus Scanning is a process of continuous checking of possible encroachment of virus in a machine with the help of a set of anti-virus software called anti-virus tool-kit. Scanning provides safety to the software and data files but its negative effects are:
- It slows down the processing
 - Requires continuous up-gradation of anti-virus software
 - It involves cost
 - It does not guarantee against the damage by new virus.

8. (a) Write a short note on PKI. [4]
(b) Explain different dimensions of E-commerce security. [5]
(c) What is Bootstrapping? [2]
(d) Write the advantages of Data Mining. [4]
(e) Write a short note on Business Engineering. [3]

Answer:

8. (a) Public Key Infrastructure, if properly implemented and maintained, can provide a strong means of authentication. By combining a variety of hardware components, system software, policies, practices and standards, PKI can provide for authentication, data integrity, defenses against customer repudiation, and confidentiality. The system is based on public key cryptography in which each user has a key pair- a unique electronic value called a public key and a mathematically related private key. The public key is made available to those who need to verify the user's identity.
- (b) The different dimensions of E-commerce security are as follows:
- **Integrity** – The ability to ensure that information being displayed on a web site or transmitted or received over the internet has not been altered in any way by an unauthorized party.
 - **Non-repudiation** – The ability to ensure that e-commerce participants do not deny (i.e., repudiate) their online actions.
 - **Authenticity** – The ability to identify the identity of a person or entity with whom we

Answer to PTP_Intermediate_Syllabus 2008_Jun 2014_Set 3

- are dealing in the internet.
- **Confidentiality** – The ability to ensure that messages and data are available only to those who are authorized to view them.
 - **Privacy** – The ability to control the use of information about oneself.
 - **Availability** - The ability to ensure that an e-commerce site continues to function as intended.
- (c) Bootstrapping means loading Operating System in Computer after the power is switched on. Bootstrapping instructions are stored in ROM. Once the power is on, the computer takes the instruction of bootstrapping from ROM and loads the Operating System from hard disk into RAM and put the computer in operation.
- (d) Advantages of Data Mining:
- It provides finite set of values of variables with other relevant information to understand their trend and behavior.
 - It determines the significant and possible variations in the variables
 - It helps in building predictive model for future values of target variables
 - It is a guiding force for proper decision making
- (e) Business Engineering has come out of merging of two concepts namely Information Technology and Business Process Reengineering. Business Engineering is the rethinking of business processes to improve speed, quality and output of materials or services. The emphasis of business engineering is the concept of Process Oriented Business Solutions enhanced by the client-server computing in information technology. The main point in business engineering is the efficient redesigning of company's value added chains. Value added chains are a series of connected steps running through a business which when efficiently completed add value to enterprise and customers. Information technology helps to develop business models, which assist in redesigning of business processes.