PGDM DM/IB, 2015-17

TQM-Manufacturing & Services

DM545 IB515

Trimester – I & IV, End-Term Examination: December 2016

Time allowed: 2 hrs 30 min

Max Marks: 50

Roll No: _____

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** In case of rough work please use answer sheet.

Sections	No. of Questions to attempt	Marks	Marks
A	3 out of 5 (Short Questions)	5 Marks each	3*5 = 15
B	2 out of 3 (Long Questions)	10 Marks each	2*10 = 20
C	Compulsory Case Study	15 Marks	15
		Total Marks	**50**

Section A

Q1. What kind of costs should organizations invest in most-prevention costs, appraisal costs, internal failure costs or external failure costs? Give reasons.

Q2. Explain the DMAIC process using some example? Discuss as to why six sigma process is carried out?

Q3. What is Kaizen? What are five gemba principles in gemba management?

Q4. What is ISO 9000? What are the various certifications under this umbrella of ISO 9000? Is ISO 9000 a type of certification?

Q5. In an electrical circuit, the capacities of the component should be between 24 and 40 picofarads (pF). A sample of 25 components yields a mean of 30 pF and standard deviation of 3 pF. Calculate the process capability index Cpk, and comment on the performance. If the process is not capable, what proportion of the product in nonconforming, assuming a normal distribution of the characteristics.

Section B.

Q1. "TQM is much wider term than TQC and includes TQC in itself"- taking a workable example from any manufacturing industry, discuss the implementation of TQM framework? Highlight exclusively the role of TPM in implementation of TQM?

Q2.

1. M/s Rati Tor Ltd. Ghaziabad. Produces slip ring bearings. Which look like doughnuts or washers. They fit around shafts or rods, such as drive shafts in machinery or motors. At an early stage in the production process for a particular slip ring bearing, the outside diameter of the bearing is measured. Employee have taken 10 samples During a 10 day period of 5 slip-ring bearing and measured the diameter of the bearing. The individual observation from each sample is shown as follows.

Observations (Slip-Ring diameter, in centimeters)

Sample (K)	1	2	3	4	5	Mean	Range
1	5.02	5.01	4.94	4.99	4.96	4.984	0.08
2	5.01	5.03	5.07	4.95	4.96	5.004	0.12
3	4.99	5	4.93	4.92	4.99	4.966	0.08
4	5.03	4.91	5.01	4.98	4.89	4.964	0.14
5	4.95	4.92	5.03	5.05	5.01	4.992	0.13
6	4.97	5.06	5.06	4.96	5.03	5.016	0.1
7	5.05	5.01	5.1	4.96	4.99	5.022	0.14
8	5.09	5.1	5	4.99	5.08	5.052	0.11
9	5.14	5.1	4.99	5.08	5.09	5.08	0.15
10	5.01	4.98	5.08	5.07	4.99	5.026	0.1

From the past data it is known that the process standard deviation is .08. The Company wants to develop a control chart with 3 Sigma limits to monitor this Process in the future.

2. Kolkata Glass is a manufacturer and supplier of window panes for a major construction company. In order to control the quality of its window panes, its QC manager selects 15 panes at random and inspects these for the number of manufacturing defects on each one of them. The following results are obtained.

Sample No.	No. of defects	Sample No.	No. of defects
1	3	8	9
2	12	9	11
3	21	10	10
4	3	11	11
5	7	12	8
6	8	13	7
7	3	14	2
	1	15	1

Prepare a stable control chart, based on the above data.

Q3.

1. Discuss the role of FMEA in Six Sigma?
2. Perform the process of FMEA to anticipate what you could do to eliminate any problem in two of the following process.
   a. Making a pizza
   b. Mowing of your lawn
   c. Industry excursion tour
   d. Hand break sub system of Bike
   e. ATM system of Bank

Section C

Hindustan lever Limited

Japan Institute of Plant Maintenance (JIPM) has bestowed its coveted JIPM excellence awards on Hindustan Lever Limited's (HLL) Sumerpur, Chhindwara, Yavatmal (persona!, products), and Silvassa (personal products) plants. Dadra and Amli villages near Silvassa are home to the two personal products factories of HLL.

The Dadra unit has a production capacity of 5000 tonnes per annum (tpa) and the Amli unit a capacity of 18000 tpa. These factories were set up in 1996 and 1997, respectively, and the products manufactured in these factories include fairness creams (Fair & Lovely), lotions, shampoos (Clinic, Clinic All Clear, and Sunsilk-both bottles and sachets), deodorants, tales (Denim), and toothpaste (Pepsodent).

At the Silvassa factories of HLL, the worn-out machine parts are not tossed out to the trash can as in any other factory. The workers collect these failed parts carefully as if these were 'collector's items' from a recently discovered treasure. Formal records of such parts are maintained by the workers and these parts are stored in a specially created 'museum'. The purpose served by these parts is an opportunity to understand what went wrong leading to the failure of the parts. This understanding helps in modifications of the designing or usage of the parts so that the life of the parts can be extended further. A few years ago, if the factory manager at any of the HLL factories was informed to change the size of Rin bars from 250 gms to 125 gms, he would have shuddered. This meant stopping the production line for a whole shift, resulting in loss of productivity and idle time on part of workers. Today the scene has changed completely with the changeover steps meticulously planned and rehearsed so that a major part of the changeover work is performed even before stopping the production line. The changeover time has been drastically reduced to 25-30 minutes.

A typical example can be of the Amli factory of HLL, where 40 changeovers took place in a 26 week period recently. The concept of seniority at the personal products factory at Daman has seen a transformation. A display board is maintained highlighting the skill level of workers regardless of seniority. If a senior worker does not know how to align or adjust a particular machine, there is a cross put across his name with respect to this skill on the display board. In order to learn this skill, this worker would have to find his own mentor/ trainer who many times may be junior to him. This worker may also have to find co-students in order to make it a feasible group for the training exercise.

The result is enhancement of the skill set of workers, irrespective of hierarchy leading to higher productivity and efficiency. At any other factory, purchasing a new machine has a few stereotyped steps such as placing the order for the best machinery, waiting for its delivery at the factory, installation of the machine upon its arrival, and subsequent production. Not any more at HLL factories, where, whenever the need arises for a new machine, a team of employees is sent to the manufacturer of the machinery to suggest design changes in the machine according to the unique requirements of HLL. Also, it is ensured that the new machine starts performing upto the highest efficiency as soon as it is set up, resulting in a huge cost advantage to HLL.

A typical example is demonstrated by HLL's Mangalore facility, where a new form-fi ll

seal mach i ne arrived from the manufacturer during the noon shift and it became fully operational by the night shift. This results in faster payoffs of projects and investments. Outsourcing production to third parties is commonplace in the industry today due to the fact that companies want to concentrate more upon activities such as marketing and distribution that are higher in the value chain. In contrast to this scenario, the HLL factories are gearing up to cut costs so much so that they may bag the most in-house orders. HLL's Sumerpur factory in Uttar Pradesh has demonstrated outstanding performance in cost cutting so as to win back an in-house order of a particular product, earlier being outsourced to a third party manufacturer. This has resulted in competition within the group factories and cost efficiency. Once upon a time, HLL factories were plagued with trade union troubles. This transformation is a result of three letters: T-P- M. If you happen to visit any of the HLL factories pursuing TPM, you will find gleaming floors, clearly marked areas for placing raw materials and finished goods inventory, dust covers and sealed areas for polluting substances.

The notice boards display details about various improvements brought about by the workers in their areas of activity. At times, you may come across a group of workers discussing further improvements or probable solution for a recently encountered problem. At other times, you may find a mentor conducting a training class for a couple of disciple workers.

Table 01 *TPM costs and benefits over the past three years at HLL*

Manufacturing site	*Investment (Rs Crore*	*Benefits (Rs Crore)*
Silvassa (personal products)	1.50	21.00
Chhindwara	.80	2.40
Yavatrnal	.60	6.00
urai	.45	6.00
Raipura	.42	6.20
Mangalore	.62	11.10
Daman	1.00	13.90
Sumerpur	.20	2.30

Table 01 shows the costs and benefits relating to TPM at various factories of HLL. According to HLL officials, TPM is the only business initiative resulting in returns that are 8 to 12 times the investment in the past three years. As seen in this table, the only exception to this norm is the Chhindwara factory, where the returns are 'only' three times the investment. In a typical Indian factory situation, there is almost always a feeling of mistrust between the management and the trade unions. In fact, at HLL, during the initial introduction stage of TPM, the unions considered it as another bargaining lever with the management. What would the workers get in return if the productivity is increased by a particular amount? It is important to understand the TPM factory organizational structure at HLL. At the top is the corporate TPM-steering committee headed by the HR director. At the next lower level, there is a group comprising the technical heads of HLL, the corporate quality assurance and the TPM head, and the factory managers. Below this level are the 'pillar heads'-to the managers-taking care of each one of the eight pillars of TPM. At the lowest level, there are TPM circles composed by workers and headed by an officer of HLL. Each TPM circle has a unique identity and a name. At the Silvassa unit, there are 20 TPM circles and each worker of the factory belongs to at least one of these circles. The factory-level circles meet once or twice every week, pillar heads meet monthly, and the corporate level meetings take stock of the situation once a quarter. The manager heading a TPM pillar acts as the mentor and the

coach. Whenever he notices an abnormality in his area, he has to tag it and come up with onepoint lessons (kaizens). These lessons are initially written by TPM circle leaders, in consultation with the workers in his circle. These lessons explain the reasons for the abnormality observed and the know-why associated with it. At later stages of TPM, the circle leaders encourage the workers to write such one-point lessons, who in turn become the teachers of the future. Over the past few years, HLL has created a pool of 70 odd TPM instructors as if giving itself a status of a 'TPM University', as commented by a team of Japanese auditors sent by JIPM. This intellectual pool has helped HLL to make intelligent deviations from some of the norms set up by JIPM. For example, in the first pillar, jishu hozen (autonomous maintenance), JIPM suggests that there should be a gap of around four to five months in the movement from Step 1 to Step 2. In Step 1, the machines are cleaned and tagged if their condition is not alright so that these may be repaired. In Step 2, these machines are rated from bad to very good on the basis of several parameters. HLL executives thought that unless Step 2 is performed at the earliest, the machines do not become visibly different in terms of productivity enhancement or wastage reduction so as to enthuse the workers for further improvement. Similarly, JIPM does not recommend the use of office TPM at the preparatory stage of TPM in any organization. HLL had in its view the discounts offered by suppliers if payments are made earlier. HLL knew that 70% of the costs relate to raw materials and processed materials.

Therefore, it made no sense to not do TPM in the office-which is where the supplier's bills are processed. An early payment to suppliers requires quicker documentation and here, TPM is of great use to the office employees. In order to replicate the good practices evolved out of kaizens in some of its factories, HLL has created seven-eight knowledge management (KM) teams (equipment- wise). For example, for the form-fill-seal machines used in Chhindwara, Rajpura, and Mangalore, one person was picked from each factory to form a KM team to replicate the good practices elsewhere. Enthused with the results of TPM implementation, HLL management has decided to implement this initiative at every strategic site and all new factories, including Unilever factories in the region.

Q1. Why has the TPM programme at HLL overshadowed all other programmes such as TQM?

Q2. How do you think HLL would have overcome barriers created by the trade unions during the introduction of TPM in the organization?

Q3. Deviating from the norms of JIPM may result in HLL getting disqualified for the JIPM awards in the future. Give your views?

Table VII Factors for Constructing Variables Control Charts

	$\bar{X}$ Chart			R Chart		
	Factors for Control Limits			Factors for Control Limits		
n[a]	A_1	A_2	d_2	D_3	D_4	n
2	3.760	1.880	1.128	0	3.267	2
3	2.394	1.023	1.693	0	2.575	3
4	1.880	0.729	2.059	0	2.282	4
5	1.596	0.577	2.326	0	2.115	5
6	1.410	0.483	2.534	0	2.004	6
7	1.277	0.419	2.704	0.076	1.924	7
8	1.175	0.373	2.847	0.136	1.864	8
9	1.094	0.337	2.970	0.184	1.816	9
10	1.028	0.308	3.078	0.223	1.777	10
11	0.973	0.285	3.173	0.256	1.744	11
12	0.925	0.266	3.258	0.284	1.716	12
13	0.884	0.249	3.336	0.308	1.692	13
14	0.848	0.235	3.407	0.329	1.671	14
15	0.816	0.223	3.472	0.348	1.652	15
16	0.788	0.212	3.532	0.364	1.636	16
17	0.762	0.203	3.588	0.379	1.621	17
18	0.738	0.194	3.640	0.392	1.608	18
19	0.717	0.187	3.689	0.404	1.596	19
20	0.697	0.180	3.735	0.414	1.586	20
21	0.679	0.173	3.778	0.425	1.575	21
22	0.662	0.167	3.819	0.434	1.566	22
23	0.647	0.162	3.858	0.443	1.557	23
24	0.632	0.157	3.895	0.452	1.548	24
25	0.619	0.153	3.931	0.459	1.541	25

[a] $n > 25$: $A_1 = 3/\sqrt{n}$ where n = number of observations in sample.