2004 S8PM QUALITY ENGINEERING AND MANAGEMENT

Time: 180 minutes Max marks:100

Use of Statistical Tables is permitted. Choose a significance level of 0.05, wherever applicable.
Graph sheet will be provided, if required.
All questions carry 5 marks each, except where mentioned otherwise.

1. Discuss the various definitions of quality.

2. What are the possible benefits of ISO9000 certification to an organization?

3. Explain what do you mean by Vision, Mission and Quality Policy statements. Give examples.

4. Describe how to deal with customer complaints.

5. What are the various stages of team development? Explain.

6. Compare the Seven Step Problem Solving methodology with the PDSA cycle.

7. What are the salient features of the Kaizen philosophy?

8. Describe Ishikawa's principles for good Customer Supplier relationship.

9. The various elements of quality costs in an organization for a period of one month are as follows:

Element	**Rupees in lakhs**
Customer satisfaction measurement	1.5
Visits to customer to investigate complaint	2.2
For replacing goods rejected by customer	5.5
Warranty repair	1.8
Product modification due to design mistakes	7.5
New product field trial	2.5
Supplier visit before order placement	3.0
Supplier visit for inspection of material	4.5
Cost to obtain replacement for rejected materials from supplier	0.5
Quality education of workers	2.5
Inspection of components machined in house	3.2
Repair and rework inhouse	1.4
Assembly inspection and testing	2.4
Administration of Quality department	5.0
Lost sales	4.8

Determine the preventive cost, appraisal cost, internal failure cost and external failure cost.

10. Sketch a House of Quality Matrix and mark the various regions.

11. What do you mean by Risk Priority Number? How is it calculated?

12. A machine is scheduled to work from 9am to 5pm in a day with a scheduled lunch break of 30minutes. Today, 1.5hrs were lost due to breakage of a V-Belt. The machine produced 150 components today, which has a theoretical cycle time of 2 minutes. Of this, 8 components

had to be reworked and two scrapped. Determine the availability, performance, quality rating and OEE.

13. What are the shapes of histograms commonly obtained? How do you interpret them?

14. The volume of soft drink in a bottle is required to be monitored using an Average Range chart. Twenty samples of size 3 were collected as below:

Subgroup No	1	2	3	4	5	6	7	8	9	10
x1	196	196	201	199	200	201	197	201	200	197
x2	198	197	201	204	202	198	199	199	200	192
x3	200	197	200	200	200	201	197	204	199	204

Subgroup No	11	12	13	14	15	16	17	18	19	20
x1	198	202	199	202	202	204	198	202	196	202
x2	197	199	198	198	201	200	197	200	203	200
x3	198	193	204	198	201	199	192	195	202	198

Determine Trial Control Limits. Is the process in control? Revise the limits if necessary.
(10 marks)

15. A process monitored with an Average Range chart is in control with $\overline{\overline{x}}$=98, $\overline{R}$=3.8 and n=5. The process specifications are 100+/-5units. Determine the process capability indices and comment. How is it possible that a process is in control but product is outside specification limits?

16. The results of a process inspection are given below:

Qty Inspected	100	90	500	400	100	100	60	50	400	200
Qty rejected	5	1	20	10	2	8	5	5	10	4

Determine Trial Control Limits and revise if out of control.

17. Explain with an example the main deficiency of a One Factor at a time experiment.

18. The marks of two students in six subjects of the final examination are given below. Is there a significant difference between the two students?

	Jack	Jill
English	54	60
Hindi	61	64
Malayalam	60	63
Maths	67	66
Science	64	69
Social studies	69	74

19. A production engineer wished to compare the tool life of three makes of carbide inserts. Is there a significant difference between the makes, if they were tested on similar work materials under similar conditions, and results of tool life obtained in minutes are as follows:

Make A	18	15	16	-
Make B	13	15	16	16
Make C	19	18	22	20

20. A Quality Circle carried out a 2^2 experiment with 2 replicates to study the effect of initial work-piece temperature and quenching bath temperature on the hardness achieved after quenching. Calculate the effects and interactions if the details are:

Workpiece temp ^oC	Quenching bath temp ^oC	Replicate 1 (HRC)	Replicate 2 (HRC)
600	100	47	49
800	100	58	56
600	200	44	46
800	200	54	56

21. The vibration level during drilling is thought to depend on drill size and cutting speed. A 2^2 experiment was conducted with four replicates as follows:

Drill Size (mm)	rpm	Rep 1	Rep 2	Rep 3	Rep 4	Mean	Variance
5	100	18.2	18.9	12.9	14.4	16.1	8.46
10	200	27.2	24	22.4	22.5	24.025	5.015833
5	100	15.9	14.5	15.1	14.2	14.925	0.5625
10	200	41	43.9	36.3	39.9	40.275	9.869167

Test for significance of the effects, if the effect of Drill size was 33.275, that of rpm was 15.075 and their interaction 17.425.

(10 marks)

22. The tensile strength of a heat of steel was determined from ten samples with the results below. Make a probability plot and test whether they come from a normal distribution.

29.9	28.8	26.3	27.9	29.1	23.5	29.3	30.7	32.2	27.6

23. In a 2^3 factorial experiment to study the effect of baking time, temperature and pressure on the density fraction of a powder metallurgy compact, the temperature was varied between 400^{o}C and 600^{o}C, time between 60minutes and 90 minutes, and pressure between 1.0 and 1.5bar. The constant effect was 40%, that of temperature 30%, that of time 4%, that of pressure -2%, the time temperature interaction 15%, pressure temperature interaction 1.5%, time pressure interaction -2.5% and the third order interaction 1%. If effects less than 5% were insignificant due to experimental error, develop a mathematical model for the density fraction. Predict the density fraction if a compact was baked at a temperature of 550^{o}C and 1.2bar pressure for 70minutes.

24. The specification for a Resistor is 12+/-0.1ohms and the average repair cost is Rs50.00. Compute the average loss if 8 samples measured 11.95, 11.92, 12.04, 12.04, 11.96, 11.88, 12.02 and 12.02 ohms.