BITS, PILANI – DUBAI

First Semester 2010-2011

IV Year Mechanical
ME C443 Quality control, Assurance & Reliability — Comprehensive Examination
Date: 28-12-2010 — Weightage: 40%
Time: 3 Hrs. — Marks: 80

#	**1. Answer all the questions** **2. Assume suitable data, if required** **3. Answer the questions sequentially** **4. Statistical tables are permitted**	**Marks**
1	a. With a simple example, briefly explain pareto analysis. Specify the benefits. b. For the following data related to plastic extrusion temperature, construct box plot and comment on the results. 57 50 62 61 70 67 70 62 65 63 87 80 82 83 79	[2] [8]
2	a. Construct a fishbone diagram for poor surface finish in machining using lathe. b. The specifications of surface roughness for machining of glass are 60 ± 4 μm. A random sample of 10 glasses gave the following observations (in μm): 57,59, 57, 61, 62, 69, 60, 58, 59, 58 Calculate the Cp index and comment on the result. Assuming the distribution of the characteristic to be normal, estimate the proportion of the product that will be nonconforming. The monthly production rate of such glasses is 20000 units. For any product outside the specification limits, the cost of scrapping the unit is $2.50. Estimate the monthly scrap costs. What measures would you take to improve conditions?	[2] [8]
3	a. Define the terms AQL and LTPD. b. Construct the OC curve for the following data and determine the AQL and LTPD. Producer's risk = 5% and Consumer's risk = 10%; Sample size=20 and Acceptance number=2. (Take lot size as 1000).	[2] [8]
4	a. When will you use moving range chart? How will you determine the control limits for it? b. Construct C chart for the following data related to inspection of gears and write your inference.	[2]

Sample no.	1	2	3	4	5	6	7	8	9	10
No. of Defectives	11	10	12	9	23	14	16	4	3	7

[8]

5	a. Construct a bath tub curve and specify the regions. Also, state the types of distribution to be used for different regions. b. Accelerated life testing is conducted for a sample of 25 gears. The mean time to failure is exponentially distributed. The test is terminated after 4 failures with no replacement for failed items. The failure times for 4 gears are 300, 380, 510 and 560h. Estimate the mean life of the gears and the failure rate. Find 95% confidence interval for the mean life.	[2] [8]
6	a. Define reliability and availability. b. Assume that an automobile has four independent and identical tires. The tire reliability is 0.97. If any one of the tires is punctured, the automobile cannot be driven. Calculate the automobile reliability with respect to tires. c. A computer has two independent and identical Central Processing Units (CPUs) operating simultaneously. At least one CPU must operate normally for the computer to function successfully. If the CPU reliability is 0.96, calculate the computer reliability with respect to CPUs.	[2] [4] [4]
7	a. With an example, differentiate balanced and unbalanced experimental designs. b. The experimental results using 2^2 factorial design with three replications are given below: Determine the regression equation governing the process.	[2] [8]
8	a. Define randomization and replication. b. The effect of different costs involved for a product is analysed using taguchi's design of experiments (L4 array). Determine the SN ratios for the data to minimize the production cost and specify the optimum levels for the parameters.	[2] [8]

S.No.	Factor A	Factor B	Y1	Y2	Y3
1	Low	Low	140	141	139
2	High	Low	148	139	140
3	Low	High	138	139	140
4	High	High	149	148	144

Material X1	Operator X2	Machine X3	Production cost, AED		
			Y1	Y2	Y3
1	1	1	155	145	152
1	2	2	223	213	232
2	1	2	196	182	188
2	2	1	175	165	162

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First Semester 2010-2011

IV Year Mechanical
ME C443 Quality control, Assurance & Reliability Test 2 Open book

Date: 11-12-2010
Time: 50 min.

Weightage: 20%
Marks: 20

#	**1. Answer all the questions** **2. Assume suitable data, if required** **3. Text book and hand written class notes are permitted**	**Marks**
1	A control chart is to be constructed for diameter of piston. Samples of size 5 are randomly chosen for inspection. Standard size =100±5mm. The process mean and standard deviation are estimated to be 100mm and 2mm respectively. What is the probability of a false alarm by the control chart? If the process mean is shifted to 101mm, what is the probability of detecting the shift by the control chart after first sample?	**5**
2	A hospital recorded the feedback from its patients for a week. On Sunday and Thursday it took 20 opinions whereas on other days it took 3 less. The number of people not satisfied with the hospital is shown below from Sunday to Saturday. Sun: 7, Mon: 6, Tue: 4, Wed: 5, Thu: 3, Fri: 2, Sat: 1 Select a suitable chart for the case, and determine the essential limits. (Chart is not required)	**5**
3	A double sampling scheme has $n_1 = 40$, $n_2 = 60$, $c_1 = 1$ and $c_2 = 3$. Plot the ASN for the scheme. [Take the values of p as 0, 0.04, 0.08, 0.12, 0.16 and 0.20]	**5**
4	(a) Find a single sampling plan for the following data: lot size = 2000 (general inspection level I and normal inspection) and AQL=0.65 (b) Plot an OC curve out to 5%, increasing by increments of 0.5 %, defective for the plan established in part (a). Give AQL for a producer's risk of 5%.	**5**

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First Semester 2010-2011

IV Year Mechanical
ME C443 Quality control, Assurance & Reliability — Test 1
Date: 24-10-2010 — Weightage: 25%
Time: 50 min. — Marks: 25

#	**1. Answer all the questions** **2. Assume suitable data, if required** **3. Return the QFD sheet with answer script** **4. Copy of Appendix A3 is permitted**	**Marks**

1 The failure data related to plastic lever-shaft assembly is given below. Form FMEA table and calculate RPN for the data and write your inference.

Components	Types of failures	Reasons for failure	Effects of failure	Severity	Frequency	Detection possibility
Plastic Lever	Plastic lever breaks	Overload on lever	No drive	Very high	1 in 3	Very high
	Wear at hole in lever	High unit loading	Excessive free play	High	1 in 20	Low
Shaft	Loose fit	Thermal set of plastic lever	Lever slides off the serration	High	1 in 8	Low
	Mis orientation	Inadequate press fit	Improper linkage geometry	Moderate	1 in 80	Moderate

Use the table below for rating.

Score	Severity Criteria	Occurrence		Detection
10	Hazardous w/o warning	>=1 in 2	Very High	Absolute Uncertainty
9	Hazardous with warning	1 in 3	Very High	Very Remote
8	Very High	1 in 8	High	Remote
7	High	1 in 20	High	Very Low
6	Moderate	1 in 80	Moderate	Low
5	Low	1 in 400	Moderate	Moderate
4	Very Low	1 in 2,000	Moderate	Moderately High
3	Minor	1 in 15,000	Low	High
2	Very Minor	1 in 150,000	Low	Very High
1	None	< 1 in 500M	Remote	Almost uncertain

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2 Public transportation is used by an employee to get to work each day. Samples of times recorded are shown. Times are in minutes. Estimate the essential points for the box plot and comment on the results. (80, 75, 90, 95, 65, 65, 80, 85, 70, 100) — 7

3	Fill the data (related to CAD/CAM books) in the QFD chart, estimate the absolute score & goals for the characteristics and comment on the results.	7
4	Design specifications call for a target value of 16.0 ±0.2 OZ for a cool drink. (USL = 16.2 OZ & LSL = 15.8 OZ). Observed process output has now shifted and has a mean of 15.9 OZ and a standard deviation of 0.1 OZ. Calculate the cpk value for the data and determine the %non-conformity.	4

			FEATURES				
			Codes Introduction (1)	CAD CAM Prog. Theory (2)	Programming applications (3)	Tool selection (4)	Tool life exercises (5)
REQUIREMENTS	Weights						
Optimization Programming	3		5	4			
CAD/CAM Interface	5		3	5	3		
Codes	4		5	3	5		
Tooling set up	4			2		5	5
CNC controller	4		4	5	4	2	
Competitors scores							
Book A			5	3	3	4	4
Book B			4	4	4	4	3
Book C			3	3	3	5	3
% CONTENTS							
Book A			12	14	8	7	12
Book B			9	10	7	8	10
Book C			8	4	6	10	11
	++	1x2, 1x3					
CORRELATION	+	3x4					

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First Semester 2010-2011

IV Year Mechanical

ME C443 Quality control, Assurance & Reliability	Quiz 2 A
Date: 12-12-2010	Weightage: 70%
Time: 20 min.	Marks: 14
Name:	ID No.:

1. Differentiate attributes and variables quality characteristics with examples. [2]
2. What do you mean by type I and type II errors in control charts? [2]
3. Differentiate defectives and defects with examples. [2]
4. List the pre requirements for construction of control charts. [2]
5. Through construction of OC curves, illustrate the effect of sample size & acceptance number [2]
6. What do you mean by ATI and ASN? [2]
7. Construct a model sequential sampling plan. [2]

BITS PILANI – DUBAI
ACADEMIC CITY, DUBAI

DATE: ~~11~~ 22-11-10
COURSE: ME C443 Quality control, assurance & reliability **Quiz 1 SET B**
CLASS: IV Yr Mechanical
Marks: 2x8=16 **Weightage: 8%** **Time: 20min.**

1. What is the advantage of cpk over cp? Sketch the condition in which the rejections are there in upper specification only.
2. What are outliers and extreme outliers in box plots? Show them with a box plot.
3. Define the terms quality control and quality assurance.
4. How will you determine the sigma level of a process? What is the significance of six sigma?
5. Define DPU and DPMO.
6. What is RTY? Specify the equation.
7. With an example, briefly explain stem and leaf plot.
8. What is the significance of a pareto chart? Sketch an example chart.