Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: Quality Control and Reliability Engineering- PE IV [AAE 479]

REVISED CREDIT SYSTEM
(06/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. What is the difference between quality control and quality improvement? Discuss the role of management in each of these settings? **(05)**

1B. List and explain the four measurement scales used to classify the data. **(05)**

2A. A component is known to have an exponential time-to-failure distribution with a mean life of 10,000 hours. **(06)**
(a) What is the probability of the component lasting at least 8000 hours?
(b) If the component is in operation at 9000 hours, what is the probability that it will last another 6000 hours?
(c) Two such components are put in parallel, so that the system will be in operation if at least one of the components is operational. What is the probability of the system being operational for 12,000 hours? Assume that the components operate independently.

2B. Define and explain type I and type II errors in the context of control charts. Are they related? **(04)**

3A. The length of industrial filters is a quality characteristic of interest. Thirty samples, each of size 5, are chosen from the process. The data yields an average length of 110 mm, with the process standard deviation estimated to be 4 mm. **(05)**
(a) Find the warning limits for a control chart for the average length?
(b) Find the 3σ control limits. What is the probability of a type I error?
(c) If the process means shifts to 112 mm, what are the chances of detecting this shift by the third sample drawn after the shift?

3B. Health care facilities must conform to certain standards in submitting bills to Medicare/Medicaid for processing. The number of bills with errors and the number sampled are shown in Table 1. Construct an appropriate control **(05)**

chart and comment on the performance of the billing department. Revise the control limits, if necessary, assuming special causes for out-of-control points. Comment on the capability of the department.

Table 1

Observation	Bills with Errors	Number Sampled	Observation	Bills with Errors	Number Sampled
1	8	400	14	3	300
2	6	400	15	5	300
3	4	400	16	8	300
4	9	400	17	11	500
5	7	400	18	13	500
6	5	400	19	8	500
7	5	300	20	7	500
8	7	300	21	8	500
9	4	300	22	4	500
10	15	300	23	3	500
11	6	300	24	7	500
12	7	300	25	6	500
13	4	300			

4. Mr. Saravanan is the quality assurance manager at Ashok Leyland's H series engine plant. You are the student intern assigned to him as a part of your finishing school. The intern's first task is to calculate the following, based on the SPC information at the engine plant given below: **(10)**

AQL = 0.01, Producer's risk = 5 %, Consumer's risk = 5 %, *N* = 1000, LTPD=0.04

(i). Propose a single sampling plan that best fits the given parameter values and draw the OC curve by taking probabilities of acceptance for values of proportion defectives from 0.01 to 0.1 in steps of 0.01.
(ii). Draw the AOQ curve and find the AOQL for the sampling plan.

5A. A manufacturing plant is using double sampling plan with parameters as N=1000, n_1=40, n_2=60, c_1=2 and c_2=5 for the inspection of a semi-finished product arriving from a subcontractor. (i)With the help of flow diagram, explain the operation of the plan. **(04)**
(ii) Compute the ASN for batches with proportion non- confirming of 0.04, assuming no curtailment. The probability of making a decision at the end of first sample is given as 0.82.

5B. Under what circumstances, a quality control engineer should prefer Dodge-Romig sampling scheme over MIL-STD 105 E system? **(02)**

5C. For the inspection of a wind turbine blade, it is decided to use a single-Sampling plan for the lots that are shipped from a supplier in lots of 2500. The supplier's process operates at a fallout level of 0.50% defective. Management want the AOQL from the inspection activity to be 3%. **(04)**
(i) Find the appropriate Dodge–Romig plan. (ii) What is the LTPD protection for this plan?
(iii) Compute the ATI, if there is a probability of acceptance of 0.985 for the incoming lots?

6A. One of the industrial robots designed by a leading producer has four major components say A, B, C and D with reliability of 0.98, 0.95, 0.94, and 0.90 respectively. All of the components must function in order for the robot to operate effectively. **(03)**

(i) Calculate the reliability of the robot.

(ii) Designers want to improve the reliability of the robot by adding a backup component. Due to space limitations, only one backup can be added. The backup for any component will have the same reliability as the unit for which it is the backup. Which component should get the backup in order to achieve the highest reliability of the robot?

6B. Explain the procedure to be followed for estimation of risk priority number (RPN) as a part of failure mode and effect analysis (FMEA)? **(03)**

6C. 8 components on an automobile prototype were tested to destruction, and the distance to failure (in 10000 km) were observed to follow exponential distribution which is given as **(04)**

Distance to failure in 10000 km	5.6	6.9	8.2	10.3	13.2	16.7	19.7	24.6.

Find the mean distance to failure (MDTF), failure rate, the reliability at 5000 km and the distance at which reliability is 80%.