

MANIPAL INSTITUTE OF TECHNOLOGY

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 (06/01/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

Answer ANY FIVE FULL questions.

• Missing data may be suitable assumed.

- **1A.** Differentiate between specification and standards, conformities and nonconformity, **(05)** quality and reliability.
- **1B.** Explain prevention cost, appraisal cost, internal failure cost for a quality. (05)
- 2A. A company has been able to restrict the use of electrical power through energy (06) Conservation measures. The monthly use is known to be normal with a mean of 60,000 kWh (kilowatt-hour) and a standard deviation of 400 kWh.

(a) What is the probability that the monthly consumption will be less than 59,100 kWh?

(b) What is the probability that the monthly consumption will be between 59,000 and 60,300 kWh?

(c) The capacity of the utility that supplies this company is 61,000 kWh. What is the probability that demand will not exceed supply by more than 100 kWh

- **2B.** Define and explain type I and type II errors in the context of control charts. Are they **(04)** related?
- **3A.** The time to failure of an electronic component can be described by a Weibull (05) distribution with $\gamma = 0, \beta = 0.25, \alpha = 800$ hours
 - (a) Find the mean time to failure.
 - (b) Find the standard deviation of the time to failure.
 - (c) What is the probability of the component lasting at least 1500 hours?
- 3B. Observations are taken from the output of a company making semiconductors. Table (05) 1 shows the sample size and the number of nonconforming semiconductors for each sample. Construct a p-chart by setting up the exact control limits for each sample. Are any samples out of control? If so, assuming special causes, revise the centerline and control limits.

Observation	Items Inspected	Nonconforming Items	Observation	Items Inspected	Nonconforming Items
1	80	3	14	90	4
2	120	6	15	160	5
3	60	4	16	230	3
4	150	5	17	200	12
5	140	8	18	150	8
6	150	10	19	210	6
7	160	7	20	190	4
8	90	6	21	160	9
9	100	5	22	100	8
10	160	12	23	100	12
11	110	8	24	90	7
12	100	5	25	160	10
13	200	14			

Table 1

4. The India Piston Ltd., a reputed tier one supplier of pistons, just received a shipment (10) of 1,500 pistons from its subcontractor Priscon Engineering Ltd. The sampling plan for inspecting these pistons calls for a sample size n=120 and an acceptance number c=2. The contract with the piston manufacturer calls for an AQL of 2 defective bearing per 100 and an LTPD of 5 defective bearing per 100.

(i) Calculate and draw the OC curve for this plan, and determine the producer's risk and the consumer's risk for the plan.

(ii) Draw the AOQ curve under rectified inspection and estimate AOQL.

- **5A.** Compare and contrast acceptance sampling Vs. 100% inspection. (03)
- **5B.** Explain the switching rules to be followed as a part of MIL-STD 105 E system? (04)
- 5C. It is decided to use MIL STD 105 E for quality control of semi-finished products under (03) the following condition;
 Batch size: 50000 produced in one batch by the supplier Single sampling plan, Normal severity, Level II
 AQL: 0 for critical defects, major defects 1 % and minor defects 2.5 %. Propose and

AQL: 0 for critical defects, major defects 1 % and minor defects 2.5 %. Propose and interpret the sampling plan for the above case.

- 6A. A system consists of three units whose reliability block diagram is in series. The (03) failure rate of each unit is a constant as follows. λ1 =4.6 x 10 -6, λ2 =4.6 x 10 -6, λ3 =9.8 x 10 -6. Determine (i) MTTF of the system (ii) Reliability of the system for a mission of 100 hours.
- **6B.** Suppose that the mean cycles between failures (equivalent to MTBF) of a product **(03)** are 100,000 cycles. What should be the warranty period, if the manufacturer wishes to pay for repair of only 10% of the devices?
- **6C.** 20 components product prototypes were tested using HALT. After 24 hours of use, **(04)** seven of them are failed at times (in hours) 2.1, 8.3, 10.9, 15.2, 16.3, 20.5 and 23.8, while the remaining 13 were still functioning. Calculate the MTTF, failure rate, the time at which reliability is 95 % and the reliability after 50 hours of use.