Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2020

Programme: B. Tech-Mechanical **Semester : VII**
Course Name: Quality, Reliability and Safety **Max. Marks : 100**
Course Code: MEPD 4006 **Max. Time : 03 Hours.**

SECTION A (30 Marks)

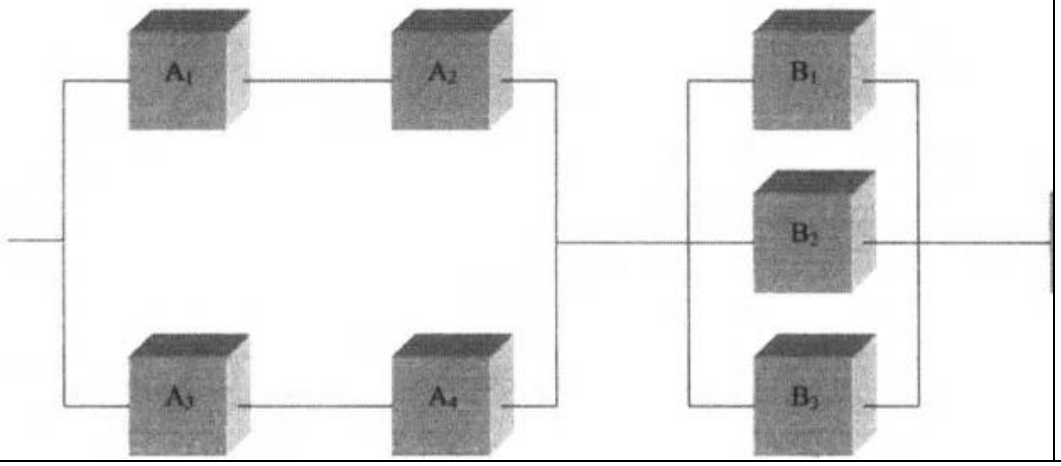
1. **All questions are compulsory in this section.**
2. **Total 06 questions are there in this section and each question is of 5 Marks.**
3. **Short answer type questions.**
4. **Assume any missing data if required.**

Q1	Relate the random causes and assignable causes in SQC. Discuss the concept of Zero defect.	**5**	**CO1**
Q2	Illustrate the seven quality tools and their importance.	**5**	**CO2**
Q3	Define (a) MTTF (b) MTBF (c) MTTR & (d) Maintainability(e) Reliability	**5**	**CO2**
Q4	Describe the four major aspects of reliability.	**5**	**CO2**
Q5	Illustrate the causes of accidents in automotive industries.	**5**	**CO3**
Q6	Analyze the importance of OC curve in acceptance sampling.	**5**	**CO3**

SECTION B (50 Marks)

1. **All questions are compulsory in this section.**
2. **Total 05 questions are there in this section and each question is of 10 Marks.**
3. **Write brief notes.**
4. **Assume any missing data if required.**

Q7	The Noise King Muffler Shop, a high-volume installer of replacement exhaust muffler systems, just received a shipment of 1,000 mufflers. The sampling plan for inspecting these mufflers calls for a sample size n = 60 and an acceptance number c = 1. The contract with the muffler manufacturer calls for an AQL of 1 defective muffler per 100 and an LTPD of 6 defective mufflers per 100. Calculate the OC curve for this plan, and determine the producer's risk and the consumer's risk for the plan.	**10**	**CO2**
Q8	A control chart is to be constructed for the average breaking strength of nylon fibers. Samples of size 5 are randomly chosen from the process. The process mean and standard deviation are estimated to be 120 kg and 8 kg, respectively. a) If the control limits are placed 3 standard deviations from the process mean, what is the probability of a type I error?	**10**	**CO2**

	b) If the process mean shifts to 125 kg, what is the probability of concluding that the process is in control and hence making a type II error on the sample plotted after the shift? c) Show these errors Type I & Type II by normal distribution curve.		
Q9	A machine is newly installed in a factory to fill bags of flour. The standard weight of each bag of flour is 2000 g's. The installing company operate the machine for one day in order to test and five samples of the output from the machine are recorded every hour. The average results for each of the five samples are as follows: 1996, 2090, 2010, 2008, 1835, 1820, 2180, 2118 grams. The specification is nominal +/- 10%. The installers complete the installation based on the above measurements. a) Are all the samples within specification? b) What is the mean, variance, standard deviation of the samples? c) How many sigma is the process? d) What is the capability of the process (Cpk)? Is it capable? e) Is the machine acceptable?	**10**	**CO2**
Q10	Discuss the relationship between safety & productivity with a suitable example. How the safety can be assured?	**10**	**CO3**
Q11	Desribes the method of prevention and spread of fire. Discuss about the emergency exits.	**10**	**CO3**
SECTION C (20 Marks) **1. Please solve one question out of two.** **2. Write long answers.** **3. Assume any missing data if required.**			
Q12	a) Find the reliability of the eight-component system. some components are in series and some are in parallel. The reliabilities of the components are as follows: RA1 = 0.92, RA2 = 0.90, RA3 = 0.88, RA4 = 0.96, RB1 = 0.95, RB2 = 0.90, RB3 = 0.92 and RC1 = 0.93. 	**20**	**CO3**

b) Find the system failure rate and the mean time to failure for the eight component system shown in Figure 11-6. The failure rates (number of units per hour) for the components are as follows ʎA1 = 0.0006, ʎA2 = 0.0045, ʎA3 = 0.0035, ʎA4 = 0.0016, ʎB1 = 0.0060, ʎB2 = 0.0060, ʎB3 = 0.0060, and ʎC1 = 0.0050.

OR

Assume that the time to failure for each component has an exponential distribution. The failure rates are as follows: λ_A = 0.0005/hour λ_B = 0.0005/hour, λ_C = 0.0003/h, λ_D = 0.0008/hour, λ_E = 0.0004/hour, λ_F = 0.006/hour, and λ_G = 0.0064/hour.

(a) Find the reliability of the system after 1000 hours.

(b) What is the mean time to failure of the system?

(c) If you had a choice of improving system reliability by modifying any two components, how would you proceed?

(d) Suppose that component B is a standby component. Find the reliability of the system after 1000 hours. What is the mean time to failure?