Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Online End Semester Examination, May 2021

Programme: B. Tech-Mechanical **Semester : VI**
Course Name: Quality, Reliability and Safety **Max. Marks : 100**
Course Code: MEPD 4006P **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	Name the eight dimensions of the quality.	**5**	**CO1**
Q2	Describe the four major differences between QC & QA.	**5**	**CO1**
Q3	Define (a) MTTF (b) MTBF (c) MTTR & (d) Maintainability(e) Reliability	**5**	**CO2**
Q4	Illustrate the importance of Reliability in terms of safety.	**5**	**CO2**
Q5	Illustrate the causes of accidents in welding shop.	**5**	**CO3**
Q6	Analyze the importance of fire exits.	**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. **Use Standard Normal distribution table & cumulative Poisson probability Table.**
4. **Assume any missing data if required.**

Q7	The ABC car company, a high-volume installer of replacement spoiler systems, just received a shipment of 1,500 pieces. The sampling plan for inspecting these spoilers calls for a sample size n = 60 and an acceptance number c = 1. The contract with the manufacturer calls for an AQL of 2 defective spoiler per 100 and an LTPD of 6 defective per 100. Calculate & draw the OC curve for this plan, and determine the producer's risk and the consumer's risk for the plan.	**10**	**CO2**
Q8	The diameter of cotter pins produced by an automatic machine is a characteristic of interest. Based on historical data, the process average diameter is 15 mm with a process standard deviation of 0.8 mm. If samples of size 4 are randomly selected from the process: (a) Find the 1σ and 2σ control limits. (b) Find the 3σ control limits for the average diameter. (c) What is the probability of a false alarm?	**10**	**CO2**

	(d) If the process mean shifts to 14.5 mm, what is the probability of not detecting this shift on the first sample plotted after the shift?		
Q9	State and explain each rule for determining out-of-control points.	**10**	**CO1**
Q10	The number of weekly customer complaints are monitored in a large hotel using c-chart. Develop three sigma control limits using the data table below. Tota Week 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 No. of Complaints 3 2 3 1 3 3 2 1 3 1 3 4 2 1 1 1 3 2 2 3 44	**10**	**CO2**
Q11	Desribes the purpose of accident reporting and investigation? Explain with an example.	**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) Four components A, B, C, and D are placed in parallel to make a subassembly in a circuit board. The reliabilities of A, B, C, and D are 0.93, 0.88, 0.95, and 0.92, respectively. Find the reliability of the subassembly. b) A sample of 20 diodes is chosen for life testing. The time to failure of the diodes is exponentially distributed. The test is terminated after six failures, with no replacement of the failed items. The failure times (in hours), of the six diodes are 530,590, 670,700,720 and 780. i. Estimate the mean time to failure of the diodes as well as the failure rate. ii. Assume that each failed item is replaced with an identical unit. Estimate the mean time to failure and the failure rate. **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?	**20**	**CO3**

	(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?