Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, May 2019

Programme Name: M.Tech.(ROTATING EQUIPMENT) **Semester : 6th**
Course Name : Quality Reliability Engineering **Time : 03 hrs**
Course Code : MREQ 821 **Max. Marks : 100**
Nos. of page(s) : 03

SECTION A

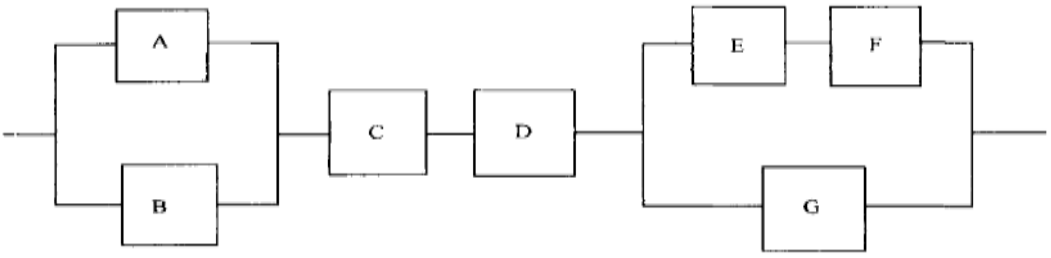
S. No.		Marks	CO
Q 1	Briefly Explain the Juran`s philosophy of quality management.	5	CO1
Q 2	Consider a system with 10 identical components connected in parallel. If the system reliability is 0.96, how poor can the components be?	5	CO3
Q 3	The number of customers who are not satisfied with the service provided in a retail store is found for 20 samples of size 100 and is shown in Construct a P- chart for the proportion of dissatisfied customers. Revise the control limits, assuming special causes for points outside the control limits.	5	CO2
Q 4	Define and explain type I and type II errors in the context of control charts. Are they related?	5	CO2

Sample	Number of Dissatisfied Customers	Sample	Number of Dissatisfied Customers
1	2	11	5
2	5	12	4
3	4	13	2
4	3	14	5
5	4	15	3
6	2	16	12
7	3	17	3
8	2	18	2
9	4	19	5
10	11	20	2

SECTION B

Q 5	Discuss elaborately the basic seven questions to be answered in implementing Reliability Centered Maintenance (RCM).	10	CO3

Q 6	Explain the safety features in applications below: (a) Machine shop (b) welding shop **OR** Explain the safety features in applications below: (a) Material handling (b) Oil & gas industries.	**10**	**CO5**
Q 7	The time to deliver packaged containers by a logistics company is found from samples of size 4. The mean and standard deviation of delivery times is estimated to be 140 hours and 6 hours, respectively. (a) Find the 2σ and 3σ control limits for the average delivery time. (b) Explain a type I and type II error specifically in this context. (c) Suppose that Rules 1 and 3 are used simultaneously to detect out-of-control conditions. Assuming independence of the rules, what is the overall probability of a type I error for 3σ control limits? (d) If the mean delivery time shifts to 145 hours, what is the probability of not detecting this by the second sample after the shift?	**10**	**CO2**
Q 8	Explain the 14 principles of Deming's philosophy of management.	**10**	**CO1**
	SECTION-C		
Q 9	i. A major automobile company is interested in reducing the time that customers have to wait while having their car serviced with one of the dealers. They select four customers randomly each day and find the total time that each customer has to wait (in minutes) while his or her car is serviced. From these four observations, the sample average and range are found. This process is repeated for 25 days. The summary data for these observations are**(10 Marks)** $\sum_{i=0}^{25} \bar{X} = 1000$, $\sum_{i=0}^{25} \bar{R} = 250$ (a) Find the $\overline{X}$ and $\bar{R}$control limits (b) Assuming that the process is in control and the distribution of waiting time is normal, find the percentage of customers who will not have to wait more than 50 minutes. (c) Find the 2σ control limits. (d) The service manager is developing a promotional program and is interested in reducing the average waiting time to 30 minutes by employing more	**20**	**CO3**

	mechanics. If the plan is successful, what proportion of the customers will have to wait more than 40 minutes? More than 50 minutes? ii. Light bulbs are tested for their luminance, with the intensity of brightness desired to be within a certain range. Random samples of five bulbs are chosen from the output, and the luminance is measured. The sample mean X and the standard deviation s are found. After 30 samples, the following summary information is obtained: **(10 Marks)** $\sum_{i=0}^{30} \bar{X} = 2550$, $\sum_{i=0}^{30} s = 195$ The specifications are 90 ± 15 lumens. (a) Find the control limits for the X- and s-charts. (b) Assuming that the process is in control, estimate the process mean and process standard deviation. (c) Comment on the ability of the process to meet specifications. What proportion of the output is nonconforming? (d) If the process mean is moved to 90 lumens, what proportion of output will be nonconforming? What suggestions would you make to improve the performance of the process?		
Q 10	Assume that the time to failure for each component has an exponential distribution. The failure rates are as follows: 0.0005, 0.0005, 0.0003, 0.0008, 0.0004, 0.006 and 0.0064/hour. Find the reliability of the system after 1000 hours. (a) What is the mean time to failure of the system? (b) If you had a choice of improving system reliability by modifying any two components, how would you proceed? (c) Suppose that component B is a standby component. Find the reliability of the system after 1000 hours. What is the mean time to failure? (d) Suppose that component B & G is a standby component. Find the reliability of the system after 1000 hours. What is the mean time to failure?  **OR** Construct a failure mode analysis flow chart and analysis the data of a centrifugal pump and wind turbine (Failures shall be assumed on your own).	**20**	**CO5**