Course: MREQ 821- Quality & Reliability Engineering   **Semester: II**
Program: M.Tech.(Rotating Equipment)
Time: 03 hrs.   **Max. Marks: 100**

Instructions:

SECTION A

S. No.		Marks	CO
Q 1	Define reliability. Explain its role in quality control and improvement	4	CO1
Q 2	What are the steps involved in reliability allocation? What are the methods for improving reliability in design phase?	4	CO3
Q 3	Consider a system with 10 identical components connected in parallel. If the system reliability is 0.96, how poor can the components be?	4	CO2
Q 4	Compare and illustrate Juran`s and corsby philosophy of quality management.	4	CO5
Q 5	What are the factors affecting Product life?	4	CO4

SECTION B

| Q 6	Discuss elaborately the basic seven questions to be answered in implementing Reliability Centered Maintenance (RCM).	10	CO4
Q 7	The outside diameter of a part used in a gear assembly is known to be normally distributed with a mean of 40 mm and standard deviation of 2.5 mm. The specifications on the diameter are (36,45), which means that part diameters between 36 and 45 mm are considered acceptable. The unit cost of rework is \$0.20, while the unit cost of scrap is \$0.50. If the daily production rate is 2000, what is the total daily cost of rework and scrap?	10	CO5
Q 8	A system consists of 5 independent components all connected in series, their failure rates are 0.0005, 0.0004, 0.0003, 0.0002 & 0.0001 per hour respectively. The specified failure rate of the series system is 0.002 per hour. Calculate the value of the failure rate to be allocated to each component.	10	CO3
Q 9	Describe the life cycle of a product. What probability distributions would you use to model each phase? ## OR Explain the 14 principles of Deming's philosophy of management.	10	CO3

<div align="center">**SECTION-C**</div>

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?
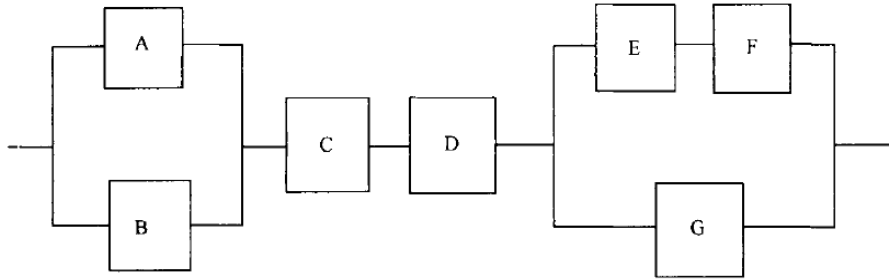	
		20	CO3

Q 11	(a) 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. Construct an appropriate control 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.	10	CO4

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			

		(b) 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 $$\sum_{i=0}^{25} \acute{X} = 1000 , \sum_{i=0}^{25} \acute{R} = 250$$ (a) Find the $\acute{X}$ and $\acute{R}$ 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 $2\acute{\sigma}$ 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 mechanics. If the plan is successful, what proportion of the customers will have to wait more than 40 minutes? More than 50 minutes?	**10**	**CO4**

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**