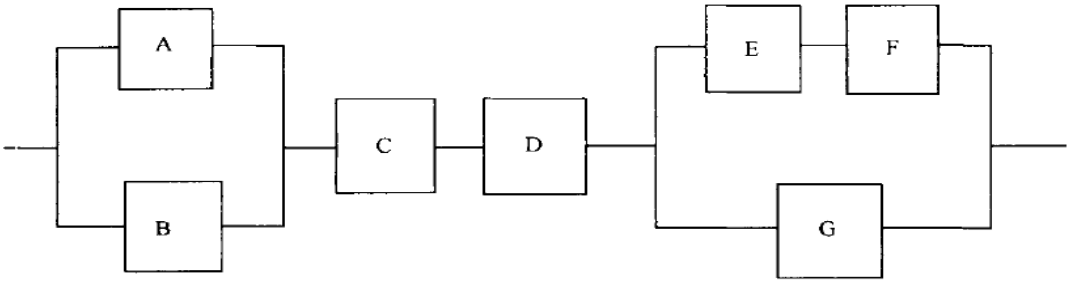
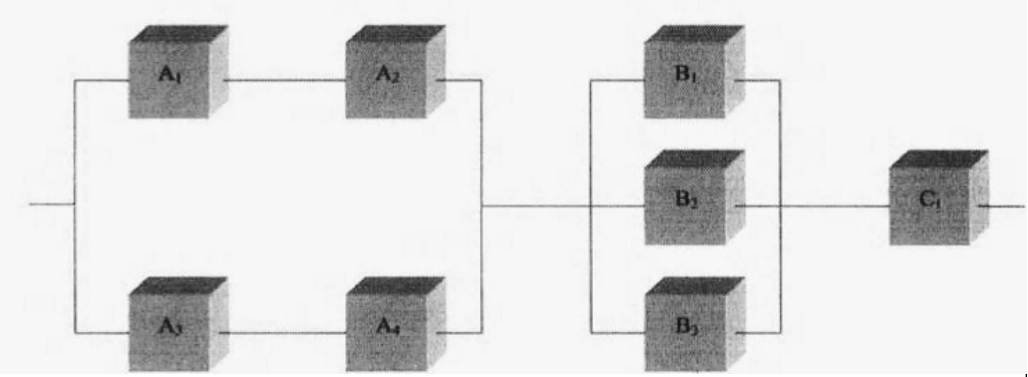
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, April 2018

Course: Maintenance and Reliability Engineering **Semester: VIII**
Program: B.Tech Production & Industrial Engineering (PIE)
Course Code: IPEG 451 **Max. Marks: 100**
Time: 03 hrs.
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	State the Failure mode effect analysis & explain its procedure.	4	CO2
Q 2	Describe the types of reliability testing. Discuss about the different parameters required for testing a product.	4	CO3
Q 3	Define the availability & explain its different types. How Availability can improve?	4	CO4
Q 4	Explain the objectives of Maintainability and how it can be measured?	4	CO4
Q 5	What is the probability of completing an action within 5 hours if the MTTR = 7 hours?	4	CO1
	SECTION B		
Q 6	**a)** A transistor has an exponential time-to-failure distribution with a constant failure rate of 0.00006/hour. Find the reliability of the transistor after 4000 hours of operation. What is the mean time to failure? If the repair rate is 0.004/hour, find the availability.	5	CO2
	b) An electronic component in a video recorder has an exponential time-to-failure distribution. What is the minimum mean time to failure of the component if it is to have a probability of 0.92 of successful operation after 6000 hours of operation?	5	CO3
Q 7	**a)** A remote control unit has 40 components in series. The reliability of each component is 0.9994. What is reliability of the remote control unit? If a redesign has 25 components in series, what is the reliability of the unit?	5	CO3
	b) Determine the system reliability for 2000 hours of operation, and find the mean time to failure. Assume that all three components are in parallel and have an identical time-to-failure distribution that is exponential, with a constant failure rate of 0.0005/ hour. What is the mean time to failure of each component. If it is desired for the system to have a mean time to failure of 4000 hours, what should the mean	5	CO3

	time to failure be for each component?		
Q 8	Explain procedures that might improve the reliability of a system. How would you increase the reliability? Select a product of your own choice. OR Describe the Accelerated life testing of a product of your own choice. What are the different accelerated testing models and the factors related to accelerated life testing.	**10**	**CO3** **CO4**
Q 9	**a)** 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. Estimate the mean time to failure of the diodes as well as the failure rate. Find a 95% confidence interval for the mean life.	**5**	**CO2**
	b) Assume that each failed item is replaced with an identical unit. Estimate the mean time to failure and the failure rate. Find a 90% confidence interval for the mean time to failure.	**5**	**CO1**
	SECTION-C		
Q 10	Consider the seven-component system shown in Figure. The reliabilities of the components are as follows: $R_A = 0.96$, $R_B = 0.92$, $R_C = 0.94$, $R_D = 0.89$, $R_E = 0.95$, $R_F = 0.88$, $R_G = 0.90$. **a)** Find the reliability of the system. If you had a choice of improving system reliability by modifying any two components, how would you proceed? .  **b)** Assume that the time to failure for each component has an exponential distribution. The failure rates are as follows: $\lambda_A = 0.0005$/hour, $\lambda_B = 0.0005$/hour, $\lambda_C = 0.0003$/h, $\lambda_D = 0.0008$/hour, $\lambda_E = 0.0004$/hour, $\lambda_F = 0.006$/hour and $\lambda_G = 0.0064$/hour. Find the reliability of the system after 1000 hours. What is the mean time to failure of the system?	**20**	**CO3** **CO2**

	OR **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: $R_{A1} = 0.92$, $R_{A2} = .90$, $R_{A3} = 0.88$, $R_{A4} = 0.96$, $R_{B1} = 0.95$, $R_{B2} = 0.90$ $R_{B3} = 0.92$ and $R_{C1} = 0.93$.  **b)** Find the system failure rate and the mean time to failure for the eight component system shown in Figure. The failure rates (number of units per hour) for the components are as follows $\lambda_{A1} = 0.0006$, $\lambda_{A2} = 0.0045$, $\lambda_{A3} = 0.0035$, $\lambda_{A4} = 0.0016$, $\lambda_{B1} = 0.0060$, $\lambda_{B2} = 0.0060$, $\lambda_{B3} = 0.0060$, and $\lambda_{C1} = 0.0050$		
Q 11	**a)** Draw a FMEA table for a ball point pen. Give some suggestions to solve the problem. When FMEA should be conducted? **b)** Distinguish between a system with components in parallel and another with standby components. **c)** Explain the relation between Quality safety and reliability. Elaborate with an suitable example. **d)** Discuss about the different types of maintenance and their selection criteria.	**20**	**CO2** **CO3** **CO1** **CO1**