E

Reg. Number……………….
                                                  Name…………...…………..

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
M.TECH DEGREE EXAMINATION, DECEMBER 2020
FIRST SEMESTER

Energy Management

Process Reliability Engineering

Time : 3 Hours   **Max. Marks: 60**

PART A
Answer All Questions

1. How reliability, failure density, and failure rate are related with each other.

2. A certain type of electronic component has a uniform failure rate of 0.00001 per hour. What is the reliability for a specified period of service of 10,000 hours?

3. An element has a probability of successful operation of 60% over a given period of time. If 4 such components are connected in parallel estimate the improvement factor.

4. Explain why there is a point of diminishing returns in using redundancy configurations.

                                                    4 x 5 marks = 20 marks

PART B

5. Following Table gives the results of tests conducted under severe conditions on 1000 safety valves. Obtain the failure density and hazard rates for various time intervals.

Time interval	0-4	4-8	8-12	12-16	16-20	20-24
No. of failures	267	59	36	24	23	11

OR

6. Explain the salient features of a bath-tub curve.

7. For the reliability analysis, 300 diodes were placed for a life test. After 1500 hr, 16 diodes had failed and test was stopped. The times at which failures occurred are: 115, 120, 205, 370, 459, 607, 714, 840, 990, 1160, 1188, 1300, 1380, 1414, 1449 and 1497 hours. Determine the failure rate of the diodes.

OR

8. Explain the Weibull model for reliability prediction with necessary sketches.

9. Derive expressions for system reliability in the case of parallel and series configurations.

OR

10. A pipeline carrying fluid has two valves as shown below.

Draw the Reliability Block Diagram (RBD) if (a) both of them are normally closed and expected to open when required to permit flow, and (b) both of them are normally open and expected to close to block the flow.

11. A product designer must decide if a redundant component is cost-justified in a product. The product in question has a critical component with a probability of 0.98 of operating. Product failure would involve a cost of $20,000. For a cost of $100, a switch and backup component could be added that would automatically transfer the control to the backup component in the event of a failure. Should the backup component be added if its operating probability is also 0.98?

OR

12. Following figure shows the RBD of a system and the corresponding component reliability values are also indicated.
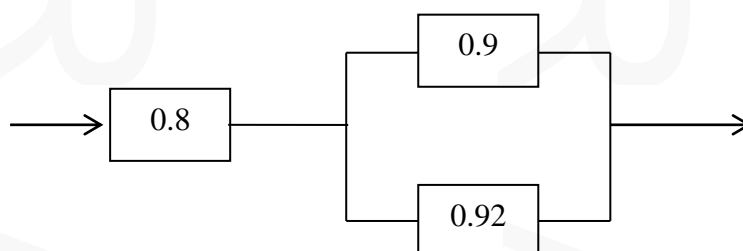
If the system reliability is to be improved by 20% by introducing a redundancy for the component that is presently having 80% reliability, calculate the minimum value of reliability required for the redundant component.

4 x 10 marks = 40 marks