Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER B. TECH. (INSTRUMENTATION AND CONTROL ENGG.)

END SEMESTER DEGREE EXAMINATIONS, DECEMBER – 2018

SUBJECT: RELIABILITY AND SAFETY ENGINEERING [ICE 4029]

TIME: 3 HOURS **MAX. MARKS:50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A	Define the following: i. Run to failure ii. Preventive maintenance iii. Risk iv. Random variable	2M
1B	Write about necessary elements required for the design of safe product.	4M
1C	Describe the role of computer in product safety and liability.	4M
2A	List the objectives of total productive maintenance and explain the steps in autonomous improvement pillar of total productive maintenance.	4M
2B	Explain the core principles of reliability centered maintenance.	4M
2C	Explain maintenance techniques used in total productive maintenance.	2M
3A	Using Rasmussen's decision-making model, describe different types of human actions and associated error mechanisms.	3M
3B	Weibull distribution data is given in the table 3B. Find the reliability at every interval of time and also estimate the reliability of a system by using least square estimation.	4M
3C	Derive the expression for failure rate of exponential distribution by using maximum likelihood Estimator.	3M
4A	Prove that Mean Time To Failure (MTTF) of an exponential distribution is inversely proportional to the failure rate.	4M
4B	The failure time (T) of an electronic circuit board follows an exponential distribution with failure rate $\lambda = 10^{(-4)}$ /h. What is the probability that (i) it will fail before 1000 h; (ii) it will survive at least 10,000 h; (iii) it will fail between 1000 h and 10,000 h? Determine the mean time to failure.	2M
4C	With a neat flow chart, describe the construction of a generalized Reliability Block Diagram (RBD).	4M

5A	Draw the fault tree for containment spray system of nuclear power plant shown in figure 5A.	4M
5B	With neat diagram, explain life characteristic curve.	3M
5C	Derive the expression for failure rate of a continuous random variable.	3M

Time interval (h)	Failure found at end of interval
0 – 1000	59
1000 – 2000	24
2000 – 3000	29
3000 – 4000	30
4000 – 5000	17
5000 – 6000	13

Figure 3B: Experimental data.

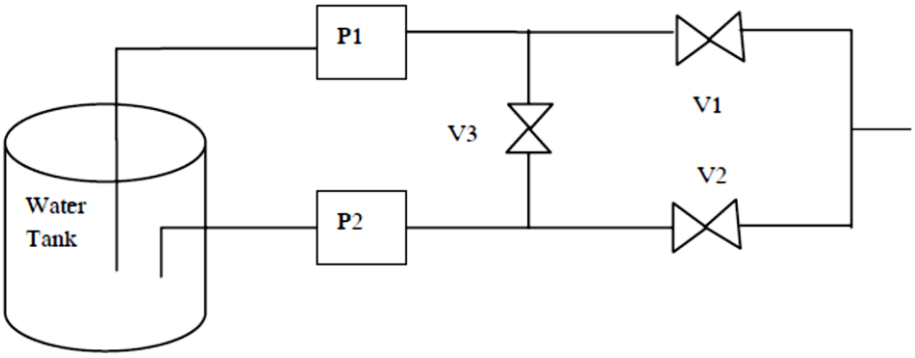

Figure 5A: Containment spray system of nuclear power plant.

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