

OCT./BE/Insem.-19
B.E. (Mechanical Engineering)
RELIABILITY ENGINEERING
(2012 Pattern) (Semester - I)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) All questions are compulsory i.e. solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data, if necessary.
- 4) Use of electronic pocket calculator is allowed.
- 5) Neat diagrams must be drawn wherever necessary.

- Q1) a)** Calculate failure density and hazard rate for the failure data of 400 Allen screws tested simultaneously for 120 hrs. [6]

Time interval (hrs)	0-20	20-40	40-60	60-80	80-100	100-120
Number of failed Allen screws	114	70	30	30	60	96

- b) Explain in brief warranty management and life cycle cost. [4]

OR

- Q2) a)** Twelve closely coiled helical (CCH) compression springs were tested for life and following results were recorded for analysis. Find the mean time to failure for 12 springs. Also find mean failure rate for $T = 300$ hrs. [6]

Specimen Number	1	2	3	4	5	6	7	8	9	10	11	12
Time to Failure hrs	205	214	225	231	243	249	254	261	268	276	285	300

- b) Define and distinguish between reliability and quality of the product. [4]

P.T.O.

- Q3) a)** The reliability of all the components (1,2,3,4,5 and 6 as shown in fig. 1) is 0.88 Find the reliability of the system assuming all the components are independent. Also, write down all the tie-sets and cut-sets for the system. [6]

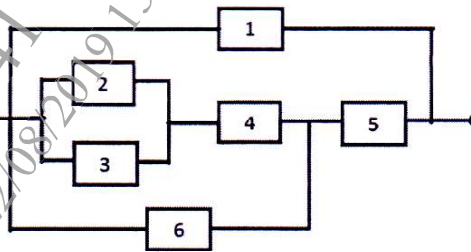


Figure 1

- b) Compare the exponential and weibull probability distributions. [4]

OR

- Q4) a)** Five elements (a,b,c,d and f) of a system are connected as shown in Fig. 2. Reliability of element A,B and C is 0.8 and reliability of elements D,E and F is 0.91 find the system reliability and write all the tie-sets and cut-sets for the system. [6]

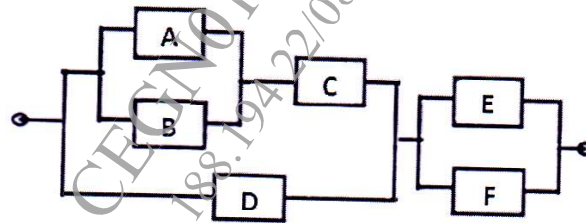


Figure 2

- b) Compare the Normal and Log-normal probability distributions. [4]

- Q5) a)** A centrifugal pump assembly consists of three critical components connected in series with reliability values of 0.62, 0.86, 0.75 respectively. The reliability of centrifugal pump is desired as 0.69. Find for which critical components the reliability values are to be improved and also find the values of individual reliabilities of the critical components by using minimum effort method. [6]

- b) Write about what is meant by redundancy, its types and its use in system with the help of sketches. [4]

OR

- Q6)** a) A system of three elements 1,2 and 3 are having failure rates $\lambda_1 = 0.007$, $\lambda_2 = 0.003$, $\lambda_3 = 0.001$ per hour respectively. Find failure rates as well as reliability of each sub system for the entire mission period using ARINC apportionment technique assuming mission time of 30 hours and desired system reliability of 0.91. [6]
- b) Prove that redundancy at element level resulting in higher reliability of the system than redundancy provided at the unit level. [4]

