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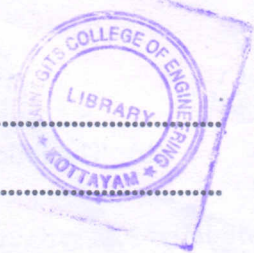
B.TECH. DEGREE EXAMINATION, MAY 2015

Fourth Semester

Branch : Electronics and Communication/Applied Electronics and Instrumentation/
Electronics and Instrumentation Engineering

RELIABILITY AND HUMANITIES (LAS)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours   Maximum : 100 Marks

Statistical tables permitted.

Part A

Answer all *questions.*

Each full question carries 20 marks.

1. (a) Two identical units A and B are operating in the standby mode. Assuming 100% reliability of the sensing and switching system, determine the reliability of the system for an operating time t. Simplify the function for the case $\lambda_A = \lambda_B$. Determine the MTTF of the system in both cases.

   (b) A system has four units of which three are connected in parallel and one is kept as standby. The units operating in parallel have failure rates λ_1, λ_2 and λ_3 per hour. The standby unit has a failure rate of λ_3 in operation and a zero failure rate during standby. A minimum of two units are required for the successful operation of the system. Evaluate the reliability of the system.
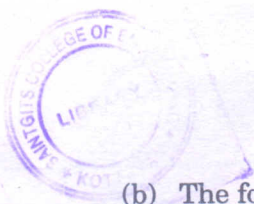
Or

2. (a) Two components with identical output characteristics are in operation in parallel. The second is added to increase the reliability of operation. The component failure rates are :

   component A : 0.02×10^{-3} t

   component B : 0.032×10^{-3} t.

   Find the system MTTF and reliability for an operating time of 1000 hour.

Turn over

(b) The following three units are in operation in parallel in the reliability sense :

Unit		Failure/h	Repair rate/h
A	...	0.004	0.1
B	...	0.005	0.15
C	...	0.003	0.06

If the system is operating in a one-out-of three parallel system, determine :

(i) System availability.

(ii) Frequency of system failure.

(iii) Mean down-time ; and

(iv) Mean up-time.

3. (a) Prove that the hazard model of a system having m components in parallel and each component with a constant failure rate can be approximated to a Weibull model.

(b) A system is composed of five identical independent elements in parallel. What should be the reliability of each element to achieve a system reliability of 0.96 ?

Or

4. The data below relates to the failures of terminations in a sample of 20 semiconductor devices. Each failure results from breaking of either the wire (W) or the Bond (B), whichever is weaker. The specification requirement is that fewer than 1% of terminations shall have strengths of less than 500 mg.

Failure load (mg)	B or W	Failure load (mg)	B or W
550	B	1250	B
750	W	1350	W
950	B	1450	B
950	W	1450	B
1150	W	1450	W
1150	B	1550	B
1150	B	1550	W
1150	W	1550	W
1150	W	1850	W
1250	B	2050	W

Estimate Weibull parameters for (i) Termination strength ; (ii) Wire strength ; and (iii) Bond strength. Comment on the results.

5. (a) What are the factors that has to be considered for manufacturing a quality product with reliability. Explain with suitable example.

(b) Explain the concept of benchmarking.

Or

6. (a) Discuss how the project organisation, planning and scheduling help in quality and reliability assurance?

    (b) Explain the concept of sequencing.

7. (a) Control charts for $\bar{X}$ and R are maintained on a certain quality characteristic of a manufactured product. The sub group size is 5. The values of $\bar{X}$ and R are computed for each subgroup. After 20 subgroups. $\Sigma \bar{X} = 3579$ and $\Sigma R = 186$. Compute the control limits for the above charts. If the process is under control, what is the process capability?

    (b) Explain the significance of high spots and low spots in a p-chart.

Or

8. (a) A C-chart is used to monitor the number of surface imperfections on sheets of photographic film. The chart presently is set-up based on a $\bar{c}$ of 2.6 :

    (i) Find 3-sigma control limits for this process.

    (ii) Use Poisson's approximation table to determine the probability that a point will fall outside these control limits while the process is actually operating at a μ_c of 2.6.

    (iii) If the process average shifts to 4.8, what is the probability of not detecting the shift on the first sample taken after the shift occurs?

    (b) Explain the steps in construction of p-chart.

9. (a) Describe the Payment Wages and Minimum Wages act.

    (b) Discuss the effects of workers participation in management.

Or

10. (a) Describe the Industrial Dispute Act.

    (b) Explain the relationship between human behaviour and work environment.

    (c) Explain any *one* wage incentive plan.

                                        $(5 \times 20 = 100 \text{ marks})$