(iii) Importance sampling

(iv) Markov chain Monte Carlo

Unit - V

9. Mention any five differences among variable charts and attribute charts. Define chart for proportion. 6+8=14

10. Discuss the following : 14

i) AOQ and AOQL

ii) Types of OC curves

iii) AQL and LTPD

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PG (CBCS) Even Semester Examination, May 2025

STATISTICS

4th Semester

Course No. : STSCC - 404

(Industrial Statistics and Optimization Techniques-II)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions taking one from each unit)

Unit - I

1. (a) Define reliability function and hazard function. Prove the following 3+4=7

$$MTTF = \int_0^\infty R(t)\, dt$$

(b) State the basic assumptions behind an exponential failure model. Derive the distribution from these assumptions. Show that hazard rate is constant for this model. 7

2. (a) Define a series system and parallel system. Hence show that -

i) System hazard rate is equal to the sum of the component hazard rates;

(Turn Over)

ii) MTTF is less than or equal to the minim value of component of MTTF's. 2+3+2=7

(b) Obtain the expressions for reliability function, hazard rate and MTTF, if the failure distribution is assumed to be two-parameter gamma distribution. 7

Unit - II

3. (a) Define structure function of a system. Write down the structure functions of series, parallel and k out of n system. 2+3=5

   (b) (i) Assuming $F(O^{-}) = O$ and F is an IFR distribution, show that log F(t) is concave for t in $\{ t/F(t) < 1; \quad t \geq 0 \}$

   (ii) If F is IFR distribution, then prove that $\{ F(t)\}^{1/t}$ is decreasing. 6+3=9

4. (a) Show that for a coherent system of independent component each of which has an IFRA failure distribution, has a system failure distribution which is also IFRA. 7

   (b) Define redundancy. Also explain the types of redundancy. 7

Unit - III

5. (a) What do you understand by a queue? Discuss some important applications of queuing theory. 7

   (b) Obtain the steady state solution of (M/M/I) : (∞/FCFS) queuing model. 7

6. (a) Let n be a random variable representing the number of arrivals in some time interval of length t, then show that the assumption of Poisson arrival with arrival rate λ, n obeys a Poisson distribution

$$P_n(t) = \frac{e^{-\lambda t} (\lambda t)^n}{n!} \; ; \; n = 0,1,2, \ldots$$ 10

   (b) Find the expected queue length coverage number of customers in the queue of the model (M|M|C): (∞|FCFS)} model. 4

Unit - IV

7. (a) Describe the inversion method of simulation. 7

   (b) The random variable X has probability density function $f(y/\lambda, \alpha) = \alpha \lambda (\lambda y)^{\alpha-1} e^{-(\lambda y)^{\alpha}} \ \forall \ y, \alpha, \lambda > 0$. Use the inversion method of simulation to describe the procedure of simulation of $f(y/\lambda, \alpha)$ using uniform (0, 1) 7

8. Describe the simulation methods with an example, where it is suitable. $3^1/_2$x4=14

   (i) Transformation

   (ii) Rejection